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NOTES FOR THE MONTH.

THE shortage of cereals throughout the world makes it of great importance that during the next few years this country should

Early Sowing of Winter Wheat.

produce the maximum yield of wheat of which the land is capable. In order to encourage the sowing of wheat the Government has promised that so long as the import of wheat is still controlled, the farmer will receive for his home-grown wheat, of sound milling quality, harvested in 1921, an amount equal to the average (c.i.f.) price of imported wheat of similar or comparable quality, and at the same time he will have the guarantee based upon the costs of production provided by the Agriculture Bill, which should secure him against serious loss. With this incentive on the part of the Government it is earnestly hoped that farmers will make every effort to relieve the present food situation by placing the largest possible area of their land under wheat. Farmers will be well advised, also, to use only the best varieties of wheat, of satisfactory germinating power. Under rich conditions preference should be given to a stiff-strawed variety producing grain of good milling quality. Of these, there are several on the market. In choosing a variety local experience is generally a safe guide to follow; in cases of doubt, application should be made to the nearest agricultural education centre.

Apart altogether from the question of breaking up more grass land, which may still, in suitable circumstances, be a perfectly sound policy, both nationally and economically, there are many ways of adding considerably to next year's wheat acreage. In this connection this year's bare fallows are calculated to play a very important part. The intensive corn production of the war years has, in many cases, left a legacy of weeds and impaired

productivity, and consequently farmers have had to deal this year with a greater extent than usual of bare fallows. Fortunately, the weather has been very favourable for bare-fallowing. Weeds will have been turned to useful account in the form of humus, and the soil will have recovered in fertility and in the condition known to farmers as "tilth." The importance of a good tilth cannot be overrated; no amount of subsequent manurial or mechanical treatment will make up for the deficiencies of a bad seed-bed. Farmers, therefore, especially on heavy land, should resist the temptation to sow a catch crop on a fallow already clean, and should reserve the land for the early sowing of autumn wheat. The sheeping off or ploughing in of a green crop may, in the case of a heavy soil in a wet autumn, result in the loss of soil texture and of the advantages of an early seed-bed.

Early sowing is likewise possible in many cases after "seeds" hay. The past year was not, generally, favourable for "seeds," particularly clovers, and the result has been in not a few cases a thin plant, with weeds taking the place of the absent clovers. In such cases it would, as a rule, be advisable to forego the aftermath and break up immediately the hay crop is off the ground. A half-fallow in favourable weather will, if kept rough as long as possible, kill the weeds and mitigate, if not altogether prevent, attacks by wireworm. So, also, after picking peas, winter barley or winter oats, it will in many cases, provided that the weather is suitable, be possible to sow wheat early. Recent developments in machinery have provided farmers with an effective means of speeding up autumn cultivation, and the best way of recovering the capital outlay involved is to keep the machinery going while the days are still long and the weather favourable.

On typical wheat lands, more particularly those of a heavy nature containing chalk, corn crops may be successfully repeated several times. The main consideration in this connection is suitable manuring, and either dung or artificial manures may be used with an equal measure of success.

Wheat will doubtless be sown to an appreciable extent in circumstances other than those mentioned; it is mainly desired here to draw attention to the importance of early sowing. If the seed is sown early the plant is able to make good growth before the cold, wet weather sets in, and is thus in a better position to utilise plant food and prevent "washing" in the course of the winter. If it is too forward or too luxuriant in spring it can be sheeped off without damage, and will stand up all the better at harvest.

On the average, early-sown crops give the best return. Many farmers purposely delay sowing because they fear the development of "black grass." In our climate it is safe on the whole to utilise an early seed-bed and risk the black grass; a luxuriant crop has a smothering effect on weeds, while early sowing will save seed and manure. As regards the latter, however, it may safely be said that wheat will repay the judicious use of artificial manures as well as, if not better than, most crops. The main requirement is nitrogen. About $\frac{1}{2}$ cwt. per acre of sulphate of ammonia should be applied at seed-time, followed by another $\frac{1}{2}$ to $\frac{3}{4}$ cwt. in early spring, if the condition of the crop warrants the additional dressing. In the case of wheat after a straw crop, about 2 cwt. per acre of superphosphate or 4 to 5 cwt. of basic slag should also be harrowed in at seed-time. Farmers are advised to obtain their supplies of manures early.

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OF all the unpromising propositions that could be taken in hand for garden purposes, a gravel pit at first sight might very well appear the least attractive. Nevertheless Mr. G. J. Bolingbroke, of Springfield, near Chelmsford, has shown how, by taking advantage of opportunities and exercising great ingenuity, obstacles can be overcome and an apparently sterile waste be made to produce an abundance of the choicest fruit. By the courtesy of Mr. Bolingbroke, the Ministry is able to publish the following account of his undertaking.

Some fifteen years ago the excavation of gravel which had been commenced by Mr. Bolingbroke 25 years ago in a quarry near his home ceased, and a hole over 60 feet deep and extending to about $\frac{3}{4}$ acre remained. The local authorities were in need of just such a place to deposit town refuse, and permission was given for them to lease the pit for this purpose. Later on, large building operations were commenced in the neighbourhood, and Mr. Bolingbroke again offered the use of the pit for the disposal of the excavated earth, and many hundreds of yards of the very best top soil, together with the top soil and waste earth arising from the working, was thrown in on top of the rubbish. In the course of about five years the lowest level of the pit had been raised to some 50 feet from the surface, and the hitherto almost perpendicular sides had been converted into slopes which seemed to Mr. Bolingbroke to present an ideal situation for fruit trees and garden crops. These were tried tentatively at first, but the results were such as to justify his highest hopes, and

operations were thereupon commenced which continued over most of the intervening years and have resulted in the plantation of some 550 trees. These consisted of cordon, wall, bush, pyramid and standard trees.

Shelter at the top of the pit in the form of a long brick wall and hedges already existed. The slopes were laid out in terraces upon which, as well as around the top, broad walks exceeding half a mile in length in all, with borders on either side, were constructed. The intervening slopes were covered with a thin layer of cement and sand, upon which choice fruit trees have been trained, and the walks connected with each other and with the bottom by concrete steps. The accompanying illustrations show the arrangements very clearly, but it was taken some years ago, and the slopes have since become fully covered. Some trouble was at first experienced from subsidence, but the effects of this are very little seen now. In consequence of the depth of the pit and the slope of the sides, neither sun nor rain is wasted, and an ideal forcing atmosphere is produced, so much so that crops are two or three weeks earlier than on the level ground above, late frosts are almost unknown, and ideal, summer-like conditions of climate are produced even in mid-winter.

The long brick wall previously mentioned is on the western side of the pit, and consequently has an eastern exposure. It is clothed with well-trained Morello cherries, and a visit at the middle of May showed them well set with fruit. Some two yards from the edge of the pit a long row of cordon Cox's Orange Pippins surround the west and north, and at this time gave promise of a fair crop. Between these and the edge is the path, and on the extreme edge is a trellis carrying the upper branches of the Doyenne du Comice pears trained against the slope below. These pears carried a very heavy crop of specimen fruit last year, and it is curious to note that, although there is not a heavy set below, the branches on the trellis have set fruit very thickly, without artificial fertilisation of any sort.

On the upper walk the slopes were almost entirely covered with well-trained pears: Doyenne du Comice facing east and south-east; 5 Louise Bonne of Jersey, which had again set well, although they matured over 2,500 fruit last season, and a few Emile d'Heyst facing west; 4 peaches facing south-west; and Morello cherries facing north. Round the edge of this walk are cordons of Cox's Orange Pippin apples and Louise Bonne of Jersey pears, mostly well set. A good bed of lettuce occupied a corner facing south-east, cabbage were finished, and cos lettuce just coming on.



FIG. 1.—Quarry Fruit Garden, Lancaster House, Springfield, Chelmsford.

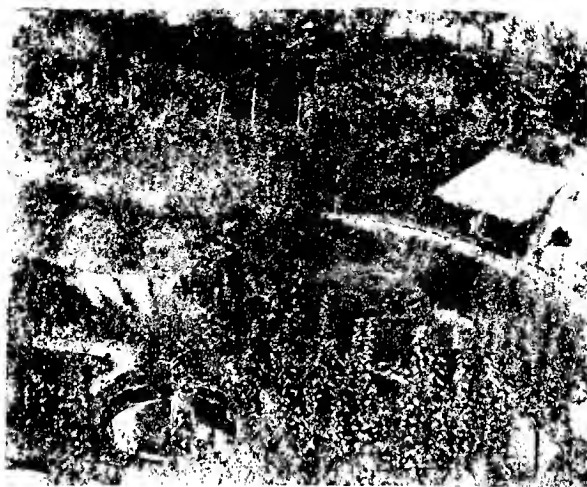


FIG. 2.—Another Section of the Fruit Garden.



FIG. 3.—Another Section.

On the lower walk trained trees of Pitnaston, which last year produced record fruit, including two specimens weighing 24 and 28 oz., faced west, and a few more peaches south-west. Monarch and other plums showing an abundance of fruit, but like so many others this year rather troubled with green fly, faced south-east, and a small plantation of bush Morellos faced north-east, with trained trees of the same on the north wall. Around the edge of this walk were bush and half standard Cox's Orange Pippin and Worcester Pearmain, all setting well, interspersed with early potatoes, and in the south-east corner a small plantation of Whinham's Industry gooseberries. About 15 years ago two old Waterloo peach trees were planted here as standards, and bore regular crops (including over 1,500 fruits in 1914) until quite recently, when, being nearly 80 years old and worn out, they were destroyed.

On the lowest slope were trained Cox's Cordon Orange Pippin, mostly well set, and on the level ground, now 50 feet below the surface, were about 40 healthy and well-grown specimens of bush peaches, pears and apples. In between these trees and on all the slopes daffodils, narcissus and other bulbs were planted in quantity.

Watering the fruit trees has been found quite unnecessary, and it is thought that the slopes collect the rain and carry it to the roots of the trees. Manure is generally applied in the form of a mulch in summer, and a proprietary plant food has occasionally been used. The trees have been kept clean and healthy by occasional winter washing with caustic soda, and, when necessary, biting and sucking insects have been disposed of by means of arsenate of lead and quassia-soap sprays respectively.

On the ground adjoining the pit an excellent fruit store to hold upwards of 300 bushels of fruit has been built in two storeys, the lower of which is underground and keeps fruit in good condition to a very late period—this year until the end of May.

The whole undertaking provides an invaluable object lesson on the utilisation of waste land.

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THE Ministry, with the approval of H.M. Treasury, has appointed Dame Meriel Talbot, D.B.E., to be Woman Adviser to the Ministry. The object of this appointment is that the fullest use may be made of women's experience, interest and work in the agricultural and rural life of the country. Dame Meriel

**A Woman Adviser
to the Ministry.**

Talbot, who has previously served as Director of the Women's Branch of the Food Production Department, has held several important public appointments, and has been connected with the Ministry for several years.

The Woman Adviser will be specially responsible for the recommendation of suitable women to serve on the Councils of Agriculture for England and Wales, the Agricultural Advisory Committee and the County Agricultural Committees and their Sub-Committees. She will make it her business to keep in touch with these bodies in order to see that women's opinions and interests are not overlooked. She will also watch the work of the Women's Institutes throughout the country and advise the Ministry with reference to grants to the Federation of Women's Institutes and kindred bodies. She will keep in close touch with the Director of Rural Industries, and will co-operate with him in any measures that can be taken to enlist the help of women in all schemes framed for the welfare or betterment of village life.

The Minister attaches great importance to arousing and retaining the interest of women in all agricultural and rural matters, and Dame Meriel Talbot will attend those conferences and committees at which matters affecting women are discussed or where a fuller knowledge of the Ministry's policy may be acquired. The welfare of the women of the country is closely bound up with the progress of agriculture. It follows that the appointment of a woman specially trained in public affairs and particularly in the work of many organisations that exist for the benefit of rural districts and rural industries cannot but prove a valuable factor in the present movement for stimulating women's interest in all matters relating to the land.

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THE conditions arising in regard to horticulture during the War, and the work of the Food Production Department during

that period, indicated the urgent need
Instruction in for the future development of national
Horticulture. education in the production of fruit and

vegetables. Hitherto large quantities of fruit and vegetables have been imported in the past, but might have been grown to advantage in this country, and from several standpoints it is important that we should produce more food, so as to become as

nearly self-supporting as possible. Lack of knowledge of the proper methods of culture has been largely responsible for our neglect of horticulture in the past, and the first step was the adoption of an extended scheme of instruction. The problem has been engaging the attention of the Ministry for some considerable time.

The importance of increased home production of all foodstuffs was apparent, and the Government set aside a considerable sum of money for the purpose of agricultural education and research, including horticultural education. It was considered that the best interests of the country would be served by an extension of the system of decentralisation. Some details as to this development will be of interest to all concerned in horticulture.

The first step was naturally the investigation and consideration of all past schemes of education to discover what errors had been made and what class of work had achieved the most useful results. It was shown that propaganda by lecture and leaflet only did not produce results fully commensurate with the money and energy expended. The Ministry therefore decided on a new scheme, the key-note of which is *the practical demonstration of approved economic methods of production of fruit, vegetables, and of honey, combined with manual, graphic and oral teaching, with the object of increasing production, efficiency in production, and the elimination of unprofitable varieties.*

The administrative work is placed in the hands of the Local Authority, who has power to set up Horticultural Sub-Committees. For the assistance of these Committees in revising existing, and in formulating new schemes, the Ministry has prepared and distributed to all those officially concerned a comprehensive memorandum embodying a complete although elastic scheme, which can be adapted to suit the particular needs of each county. This aims at the establishment of a Horticultural Instruction Centre at the Farm Institute, where demonstration fruit and market garden plots and apiaries will be established. These form the practical basis for the courses of teaching which will be varied to suit the needs of all districts. For those who intend to follow fruit and vegetable production as a business, a full year's course of day classes at the centre will be provided. This course, although not sufficiently equipping a student to commence business immediately, will form a sound basis of technical education.

For those who are unable to attend day courses, evening courses would be held either at the instruction centre or at convenient places in the county, and to assist established market gardeners and fruit growers meetings would be arranged at which approved methods would be discussed. The grounds at the centre would be available for such practical tests and experiments as the needs of the county indicate.

The allotment movement, which is now so firmly established and embraces over 1,000,000 holders, is of national importance and has not been overlooked. This would be provided for by the establishment of demonstration plots in all suitable areas.

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A scheme for combining market gardening with poultry keeping has been proposed by the Ministry, with a view to

**Market Gardening
and
Poultry Keeping.**

ascertaining how far it is possible to carry on a system of market garden cropping on a small area and at the same time to keep upon it a certain number of fowls. Three areas of one acre each have been selected, viz., at Titchfield, in Hampshire, Methwold, in Norfolk, and Rolleston, in Nottinghamshire. The acre is in each case to be divided into four quarters, and the cropping on each quarter is to be arranged so that the birds, 150 in number, are three months of the year on each quarter. A central fowl house is to be constructed, fitted with sliding doors to enable the birds to be transferred from one quarter to another according to the state of the cropping and the period during which the birds are intended to occupy any particular quarter. The manure produced each three months in any one section will be equally distributed over that section. The cropping is arranged so as to admit of the land being properly worked in the interval following the removal of the birds. Catch crops, mustard and rye for green manure, will be also introduced where possible in rotation. It is hoped that by these experiments some information will also be gained as to (1) the value of poultry manure for crops on ground in a low state of fertility, and (2) the rate at which poor land may be brought into a fertile condition by poultry manure alone.

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It is understood that certain Councils have been considering the desirability of providing fruit trees for some of their small holdings, and in view of the present shortage and the difficulty of obtaining trees of good quality and true to name, the Ministry has made arrangements for the supply of a limited number of fruit trees for planting during the coming autumn and in the autumn of 1921. The trees are not to be sold by the Council to their tenants, but are to remain the property of the Council, who will arrange for their proper planting and recoup their outlay by means of a suitable increase in the rent of the holding.

The arrangements made provide for the supply of the following varieties:—

<i>Apples.</i>	
Bramley's Seedling	Gladstone
Newton Wonder	Worcester Pearmain
Lane's Prince Albert	Allington Pippin
Grenadier	James Grieve
Early Victoria	Rival
Beauty of Bath	
<i>Plums.</i>	<i>Pears on Quince.</i>
Victoria	Conference
Czar	Dr. Jules Guyot
Purple Egg Plum	Fertility
Early Rivers	
Belle de Louvain	

A proportion of the apples will be supplied on Paradise and others on Crab stocks. All the two-year-old trees to be supplied in 1921 will be "feathered." It is advisable that a high standard of selection shall be maintained on holdings where fruit is planted, and in order that this standard may be attained the Ministry has arranged for the fruit trees to be carefully examined with a view to ensuring their freedom from disease.

The price to be charged for the maiden trees supplied this autumn will be £10 10s. 0d. per hundred, free on rail, packing extra. It is not possible at present to quote a definite price for the two-year-old trees to be supplied next year.

BEFORE the War the production of fish meal had become a considerable industry at the larger fishing ports of the United Kingdom. In 1913, out of 40,000 tons produced, 30,000 were exported to the Continent, mainly to Germany, where fish meal found a ready sale. In this country it has been used in steadily increasing quantities to feed pigs and poultry, but has been little employed for the food of other classes of live stock. **Fish Meal as Food for Live Stock.** Manufacturers will be obliged to resume the export trade unless British farmers will recognise the value of this product as a feeding stuff. Purchasers should distinguish between fish meal manufactured for use as a feeding stuff and the manurial article sold under the title of fish guano. The fish meal for feeding is made from fresh offal, together with whole fish that are unsaleable owing to a glut in the market. Care is taken that the ingredients be wholesome, but in the preparation of fish guano the question of suitability for animal feeding does not arise, and this product should therefore be avoided as a foodstuff. The composition of fish meal varies, but it should contain over 50 per cent. of proteins (albuminoids) and 25 per cent. or so of ash, which mainly consists of phosphate of lime. It is, therefore, specially rich in proteins and phosphate of lime, flesh and bone formers. Owing to the small proportion of carbohydrates, fish meal cannot exercise its full value unless it is used together with other feeding stuffs rich in this constituent, as for example, green fodders, roots and grain foods, or the more starchy feeding stuffs like maize and milling offals.

It has been objected that fish meal taints the carcass, but this occurs only where it has been given in undue proportion. A rough but useful general rule is that fish meal should not form more than about one-eighth of the total dry food consumed. This will produce pork and bacon of excellent quality, quite free from fishy taint, provided that the fish meal is good and not too rich in the fish oil which carries the fishy taint. For this reason careful manufacturers reject herrings as a constituent of fish meal.

In order to secure the essentials just noted, the Association of Fish Meal, Fish Guano and Fish Oil Manufacturers—representing nearly all the manufacturers of fish meal in Great Britain—has agreed to produce, from white fish only, a meal to be sold as “white fish meal,” and to conform with the following limits as to composition:—

Albuminoids	-	-	-	-	Not less than 55 per cent.
Phosphate of Lime	-	-	-	-	" " " 16 " "
Oil	-	-	-	-	" " " 5 " "
Salt	-	-	-	-	" " " 4 " "

Such a meal should be light brownish in colour, well ground, and free from large pieces of bone. It should be free, also, from the offensive smell of decayed fish. If its moisture content is not above 18 per cent., or thereabouts, the meal should keep well for a considerable period in a dry store, fitted preferably with a wooden floor.

In Scandinavia and elsewhere on the Continent, fish meal has been found very useful for all kinds of stock. The use in this country for pigs and poultry is large and still increasing. Recent experiments at Reading College proved its value as a supplementary food in rearing calves on whey. In this experiment, however, it should be noted that fish meal formed from cod liver was invariably rejected by the animals. Other fish meals, however, gave most satisfactory results. Scottish cattle feeders have found that it succeeds well to the extent of 2 to 3 lb. per head per day. Scandinavian farmers have demonstrated that 4 lb. or even more per head can be fed to dairy cows without imparting a fishy taint to the milk. Here, albuminoids are specially required, and it would appear, therefore, that fish meal has an especial usefulness in milk production. There is, however, a risk of direct contamination of the milk through the agency of the milker if he, or she, has happened to handle the foods before milking. Only where the greatest care is exercised can the use of fish meal for milch cows be recommended, but where due precautions are observed, and the proportion of the richer cakes, such as decorticated cotton and earthen cake, is small, fish meal up to 3 lb. per head per day may be given without ill effects. In the rearing of calves fish meal is satisfactory because of its richness in albuminoids and bone phosphate. Experiments at Kilmarnock demonstrated the usefulness of the following mixtures:—

(1) Oatmeal	-	2 parts.	(2) Fine Thirds	-	2 parts.
Fish Meal	-	1 part.	Fish Meal	-	1 part.

These ingredients were mixed with boiling water into a kind of porridge and fed with whey. The whey and meals were introduced gradually when the calves were three weeks old, until at six weeks the supply of whole milk was entirely stopped, 1 gallon of whey and $\frac{1}{2}$ lb. of meals constituting the daily ration. This was increased gradually to $1\frac{1}{2}$ gallons of whey and 1 lb. of meals. Hay was introduced when the calves were five weeks old, and linseed cake three weeks later, fed in increasing quantity.

In the Reading experiments, carried out under the auspices of the Ministry, the following mixtures gave excellent results:—

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|-------------------------------|-----------------------------|
| (1) Linseed Meal - 3 parts. | (2) Linseed Meal - 2 parts. |
| Bean Meal - 3 „ | Fish Meal - 1 part. |
| Fish Meal - 1 part. | |
| (3) Linseed Meal - - 3 parts. | |
| Finely Ground Oats - 3 „ | |
| Fish Meal - - 1 part. | |

Beginning when the calves were two weeks old, the meals were fed with whey, gradually replacing whole milk until, at the age of one month, the calves received daily 1 gallon of whey and 1 lb. of meal. At the outset the meal was mixed with whey, but the calves soon took to it in the dry form. From four weeks onward they were given hay, and a little later a small allowance of linseed cake, coconut cake and maize gluten feed.

It is essential that fish meal used for calf-rearing should be of the best quality and finely ground. It is a useful supplementary food for sheep on roots and may be fed at the rate of 2 to 3 oz. daily per 100 lb. live weight, together with roots or other green food. For pigs, a useful proportion is from one-ninth to one-seventh of the total dry foods, rising in the last month to more than 1 lb. per head daily. Such feeding leaves no detrimental trace upon the colour, smell, taste or cooking qualities of the meat. Before feeding to pigs the sample should be tasted in order to see that it does not contain too much salt, which, in any appreciable quantity, is injurious.

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DURING the season 1921 the Ministry has decided to permit the planting, in districts scheduled as Infected Areas under the

Wart Disease of Potatoes Orders, of first early potatoes of varieties susceptible to Wart Disease. The concession made to market

growers in 1919 for the year 1920 to introduce fresh "seed" of first early susceptible varieties into Infected Areas will now be extended to all growers. The effect of this decision is that, next year, any true first early variety of potato, whether "own-saved" or otherwise, as well as the variety "Eclipse" and any variety recognised by the Ministry as being of the "Eclipse" type, may be planted in any land in an Infected Area other than land on which Wart Disease has been known to exist.

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It is now generally felt that the requirements of agriculture for artificial fertilisers are likely to be much larger in the future than in former years. This may be anticipated especially with regard to nitrogen, of which increasing supplies will be needed in

**Nitrogen from
the Air.**

the development of a more intensive cultivation of the wheat-growing areas of the world. The imperative need for maintaining and extending the world's production of food, and the vital importance of combined nitrogen for this purpose, has been emphasised by the lessons of the War. Attention was drawn to the importance of increasing the nitrogen supplies of this country by the Nitrogen Products Committee, which was appointed by the Government in 1916 to consider the whole question of the development of this source of wealth. The Report of the Committee,* issued some months ago, contains a number of recommendations by which it is considered the output of nitrogen available for explosive and agricultural purposes might be increased. Details are also given in the Report of the various methods of the fixation of atmospheric nitrogen, in order that supplies may be utilised to the fullest possible extent. As is generally known, the methods have for their object the separation of the gaseous nitrogen from the air by a chemical process, and its conversion into a solid substance in a form readily available for use as a fertiliser or other purpose.

Definite measures seem now to be in progress for the fixation of atmospheric nitrogen on a scale commensurate with its importance to the security and economic stability of this country. A syndicate has been formed by Messrs. Brunner Mond & Co., and has acquired a factory and commenced the preliminary arrangements for the production of nitrogen by one of the several known processes of fixation. A short account of the objects of the syndicate and the work which has so far been accomplished was published in the issue of the *Journal of the Society of Chemical Industry* for 30th April last. It appears that the syndicate has selected the process which consists essentially in the manufacture of ammonia by the combination of nitrogen and hydrogen at a high temperature under pressure. The ammonia thus formed will be converted into nitric acid and nitrates.

It is pointed out in the article that the normal output of ammonia in this country is quite insufficient to supply the enormous demands for explosives in modern warfare, while ammonia in the form of ammonium sulphate is by far the most

* See this *Journal*, February, 1920, p. 1112.

important fertiliser we produce. To the extent to which it is used for explosives it must be diverted from agriculture just at the time when it is imperative to increase the home-grown food supply to the utmost extent. This was the situation with regard to ammonia during the War.

The case for increasing the home supplies of nitrogen is thus clearly established and urgent. Agriculturists may watch with close interest the results which attend the pioneer attempts in industry to render this country independent of foreign markets for our supplies of this essential fertiliser. It is on the success of such efforts, only in degree less than on the more direct efforts of the farmer, that the prosperity and security of British agriculture must largely depend.

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WHILE the farmer in a large way of business may find it economical to use young horses solely for ploughing, older horses

**The Small
Holder's Horse.**

for both ploughing and hauling, and others, again, for drawing light vehicles at a quick pace on roads, the occupier of a small holding is obliged to carry out all such work with the aid of one, or perhaps two, horses. To ex-service men and others who may be so placed, the question of the best type of horse is therefore important. The small holder's horse should be a general utility animal—one which, although it may not be the ideal horse for any particular class of work, can yet draw a plough or a loaded cart on the land, and can also travel to market with a cart containing farm or garden produce. It must be strong and active, and of the right age to perform constant work of every description.

With regard to the question of breed, it is possible to find suitable animals among Clydesdales, Suffolks, Shires, or crosses of these breeds. Sometimes crosses between heavy and light horses are found suitable. Much depends on the situation of the holding. In many districts, mountain or moorland ponies are used largely for draught purposes, except the small Exmoor and Welsh ponies, which are suitable only for pony traps. In parts of Wales, on Dartmoor and in the New Forest, there are ponies of the mountain and moorland breeds that may be described as the ideal draught animals for the small holder—inexpensive to keep, courageous, intelligent, resourceful and able to draw a considerable load at a reasonable pace. A note on these ponies appeared on p. 308 of last month's issue of this *Journal*.

Small holders in the neighbourhood of mountain and moorland districts will also find Borderland ponies very valuable. The Dale pony, for example, is used in the Dale and Fell districts of Westmorland, Cumberland and Yorkshire. The Devonshire cob is used in the Exmoor and Dartmoor districts. The larger truck pony of the New Forest is considered by many to be an ideal transport animal. Mountain and moorland ponies, however, are suitable for all parts of the country, with the reservation above-mentioned as regards Exmoor and Welsh ponies.

The beginner, when purchasing, should secure the assistance of someone who has had considerable experience of buying and selling. While it would be economical for a farmer on a large farm to select a young animal that is perfectly sound and free from blemish—an animal which should increase in value each year until it is five or six years old—the small holder's utility horse should be six years old or more when bought, and it should be purchased with a view to keeping it on the holding as long as it is able to do the work. When selecting a horse, a small holder need not necessarily reject an animal because of a blemish, provided that such blemish does not interfere with the horse's ability to work. Care, however, is needed to ensure that the animal is free from the grosser defects which unscrupulous dealers might wish to conceal.

In the Southern and Midland counties the horse should be turned out at night in a grass field all the year round, except possibly in very severe weather. If there be no paddock on the holding, the animal should be kept in a yard that has an open shed; on no account should it be tied up at night in a hot and stuffy stable. If the horse has been stabled, the transition to open-air life must be gradual.

A booklet on "The Small Holder's Horse" is published by the Ministry in the series of "Small Holders' Guides" (No. 4). Copies may be obtained on application to the Offices of the Ministry, 3, St. James's Square, London, S.W.1, price 2d., post free.

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An important prosecution under the Horse Breeding Act, 1918, was heard recently in the Ripon City Court, when three

**Prosecution for
Travelling an Un-
licensed Stallion.**

farmers were summoned, on the information of the Live Stock Officer of the Ministry, for travelling a shire horse for service without licence. There was a second charge of exhibiting the horse on premises not in the

defendants' own occupation. Under the Horse Breeding Act, as was explained in last month's issue (p. 313), any person who at any time after the 1st January, 1920, being the owner or having the control of a stallion, which for the purposes of the Regulations under the Act is deemed to have attained the age of two years, travels the stallion for service, or exhibits it on any premises not in his occupation with a view to its use for service or permits it to be so travelled or exhibited, shall be liable on summary conviction to a fine not exceeding £20, unless the stallion is at the time licensed under the Act.

Evidence was given to show that the owners of the horse applied for a licence, and that the horse was examined on behalf of the Ministry. The Ministry informed the owners that the licence was refused, the examining Veterinary Surgeon having certified the stallion to be affected with a disease prescribed in the Horse Breeding Regulations (1919) as a disease rendering a stallion unsuitable for service of mares. The owners thereupon exercised their right of appeal, and the horse was further examined by a referee appointed by the Ministry. The report of the examining Veterinary Surgeon was confirmed, and the owners were notified that the appeal had failed, and that, in consequence, they must not travel the horse. The notice was nevertheless disregarded, and the Ministry, therefore, instituted a prosecution. The three owners were found guilty, and a penalty of £1 on each count was imposed, making £6 in all, and 3 guineas was allowed towards the solicitor's expenses.

The result of proceedings by the Ministry in two other cases has also been reported. At Stockton Police Court, on the 23rd June, a horsebreeder was fined £5 and £3 8s. 6d. costs for travelling two unlicensed stallions, and for failing to produce the licence for a stallion when asked to do so. In the other case, at Scorton (Yorks., N.R.) Police Court, on the 6th July, a stallion owner was fined £15 inclusive of costs for allowing his horse to travel for the service of mares, although a licence had previously been refused by the Ministry.

(1) *East Sussex (Romney Marsh).*—Since the issue of this *Journal* for June last, two further outbreaks of Foot-and-Mouth disease have been confirmed in what was known as the East Sussex Scheduled Area, viz., on the 4th and 5th June respectively on holdings in close proximity to the original premises at

**Foot-and-Mouth
Disease.**

Running Waters, New Romney, Kent, on which the first case was confirmed on the 1st June. No further outbreak has since occurred in that district, and it is hoped that the remaining restrictions, which at present only apply to a very small area immediately around the infected places, may shortly be withdrawn.

(2) *Norfolk*.—Following upon the outbreak at Bowthorpe, Norwich, on the 1st June, referred to in last month's issue of the *Journal*, an outbreak was confirmed on the 7th June at Emneth, near Wisbech, Norfolk, in the occupation of the same owner. This extension necessitated the prohibition of the movement of animals over a much enlarged area, including the whole of West Norfolk, as well as parts of the Isle of Ely and the Holland division of Lincolnshire. Thereafter two further outbreaks occurred in the Bowthorpe scheduled area, and twelve more in the Emneth area. The last of the latter series was confirmed on the 13th July. It has been possible for the Ministry to make considerable modifications of the areas originally scheduled, and it is now hoped that, in the absence of unforeseen complications, there may be further contractions of the areas which are at present subject to restrictions on movement of stock.

* * * * *

The possibilities of using the aeroplane as a means of transport for horticultural produce have recently received consideration in France and in England.

The Transport of Food Produce by Aeroplane.

In a note published in the issue of the *Journal d'Agriculture Pratique* for 3rd June last, the economic advantages in the conveyance of the choicer varieties of market garden produce to markets by aeroplane service were mentioned, while the subject was also discussed at a recent meeting of the French Horticultural Society. A writer commenting on this method of transport in the issue of the *Fruit, Flower and Vegetable Trades' Journal* for 5th June last, points out that in addition to the great saving of time by aeroplane transport, the atmospheric conditions during the flight of the machine produce the refrigeration necessary to keep the fruit cool and in perfect condition during transit.

Actual tests of this method of transport have been made. In one test in March last, a well-known French horticulturist sent strawberries from Saint Laurent du-Var in the Maritime Alps to the Central Market in Paris by aeroplane; and consignments

of crates of strawberries have also been made, and reached Covent Garden Market by aeroplane from Paris within four hours. In both of these cases the fruit arrived in good condition at the market, and the high prices realised completely justified the experiment from the financial point of view. So far, the fruit carried has been strawberries, but it may be anticipated that other choice fruits will be carried by this agency in the near future.

* * * * *

THE photograph here reproduced has been forwarded to the Ministry by Mr. E. Roberts, County Rat Officer for Devonshire.

**Rat Catching in
Devonshire.**

and illustrates in a very striking manner the success which has attended the efforts of three of the County Rat Catchers in the course of one week's work in North Devon.

The saving of foodstuffs through such destruction will have been considerable. These 1,206 rats, if left undisturbed, would, by Boelter's computation of $\frac{1}{4}$ d. a day, have done in a year damage in foodstuffs alone at pre-war prices to the extent approximately of £460, or at present prices more than double that amount, leaving out of all calculation the increase in the number of rats that would inevitably have resulted from breeding. The rat, as is well known, is a very prolific breeder, so that when account is taken also of this fact, the potential saving would be many times the above figure.

This instance should bring home to all who may be responsible, either legally or under obligations of public duty, for undertaking measures for the destruction of rats, the value and importance of concentrated effort in the task. Public authorities, land owners, farmers, and others concerned, should realise that it is in their own as well as the national interest that measures should be vigorously prosecuted in all areas under their charge where rats are known to exist.

* * * * *

At a meeting of the Agricultural Wages Board held on Tuesday, the 6th July, the Board had under consideration obser-

**Agricultural
Wages Board.**

with regard to a draft proposal to increase the minimum rates of wages for adult male workers throughout England and Wales by 4s. per week, and decided to give formal public notice of the proposal forthwith. Before an Order can be made bringing the proposed increases



Hop of 1,205 rats trapped by three of the Devon Rat Officers in a week
in North Devon.

into operation a month must elapse from the date of the publication of the notice of proposal, during which period any objections to the increases may be lodged with the Wages Board for their consideration.

The Board adopted a report presented by Sir Henry Rew from the Committee on "Allowances" approving recommendations by the District Wages Committees for a number of counties for increases in the amounts at which employers may reckon the provision of board and lodging to workers as part payment of minimum rates of wages in lieu of payment in cash in the respective areas concerned.

It was decided to make Orders bringing into operation special rates of wages for hay and corn harvest work in Cumberland, Westmorland and Shropshire, and for corn harvest alone in Yorkshire.

The Board decided that no special rates should be fixed for the harvest in Hertfordshire, Middlesex, Dorset, Hampshire and Oxfordshire for the present year. It was also decided that the Order for Corn Harvest in operation for Oxfordshire last year should be cancelled.

The Board also made an Order, to come into operation on the 12th July, fixing revised minimum rates for female workers in Yorkshire: for workers aged 18 and over at 10d. per hour as proposed, together with proportionate rates for girls and for overtime employment.

An Order was made bringing into operation on the 12th July revised minimum rates of wages for male workers in Cheshire. The effect of the Order is that the minimum rates for male workers aged 21 years of age and over in Cheshire are increased in each case by 5s. 6d. per week, with proportionate increases for male workers under the age of 21 and in the overtime rates. The minimum rates for Cheshire will be further increased if the Board's general proposal (referred to above) for an all-round increase of 4s. per week in the minimum rates for adult male workers throughout England and Wales is in due course confirmed as an Order.

Full particulars of all Orders made by the Agricultural Wages Board are published in the *Wages Board Gazette*, the yearly subscription for which is 3s. Subscriptions should be sent to the Secretary, Agricultural Wages Board, 80, Pall Mall, London, S.W.1.

THE 1921 WHEAT CROP:

BRITAIN MUST GROW MORE.

SIR THOMAS MIDDLETON, K.B.E., C.B.

WITH the arrival of harvest the time has come for deciding on next year's wheat fields, and in this article reasons are given for urging every farmer who can grow wheat to sow as much as possible next autumn.

In most parts of the country the soil produces more food when growing wheat than when used for raising any other ordinary farm product except potatoes; and there is a limit to the demand for potatoes, while there is practically no limit to the demand for home-grown wheat.

Since a very small proportion (about 4 per cent.) of the 46 million cultivated acres of the United Kingdom grew wheat in the years before the War; since sales of wheat accounted for about 1s. 6d. in the pound only of the farmers' receipts; and since we imported four-fifths of our breadstuffs, there is a widespread impression, not only that the British wheat grower contributes a trifling amount to our total food supply, but that any effort which he might make to increase our wheat crop would have negligible results.

This impression is quite wrong, for in fact, with the exceptions of milk and potatoes, home-grown wheat contributes more to the food supply of the United Kingdom than any other farm product.

The Importance of Home-grown Wheat.—During the War a committee of experts prepared a careful estimate of the sources of the nation's food supply. It was then discovered that about 42 per cent. of our food was home-produced, and that the chief items in this percentage were: dairy produce 8.3, potatoes 7.4, wheaten bread 6, and beef 4. Meat of all kinds accounted for 10.5; but it must be pointed out that in the case of meat and also of milk the whole amount which came from our farms did not come from our own soils.

About 5 million tons of imported feeding stuffs were used in stock feeding, and if the amount of meat and milk made from these feeding stuffs is subtracted, the total percentage of the food supply derived through meat and milk from our soils would be reduced to 16.

The great importance of wheat to the nation may be stated in another way. Seventy-eight per cent. of our cultivated land

is required for the production of meat and milk, while this meat and milk between them provide about 42 per cent. of the total stock of food produced by our soils.

Wheat occupies 4 per cent. only of our cultivated land, while wheaten bread accounts for 16 per cent. of the stock of food grown on our soils. In addition, wheat offals and wheat straw contribute to the meat and milk supply; before the War less than 70 per cent. of the grain was made into bread.

If we are to make any substantial addition to our home food supply we must grow more wheat.

From these figures it may be shown that the land which we devote to wheat produces about seven times as much food per acre as the land we employ in stock-farming.

New Problems for the Producer.—For 50 years before the War the producer of British wheat regarded the consumer merely as a customer, and a bad customer he was! There was no obligation on the farmer to provide the public with bread, or, indeed, with any kind of farm produce except milk and potatoes.

But among those things which the War has changed most is the relationship between producers and consumers in this densely populated kingdom; for there are now indications that if we do not increase our home supplies we may have to go hungry. And if our people call for bread they will not be satisfied even should we offer them prime beef and mutton.

Much has been said recently in agricultural discussions about the danger of a serious fall in corn prices; there is at the moment quite as much risk of trouble for the farmer from a serious rise, for it will be agreed that scarcity prices for bread would not make agriculture a healthy industry.

The Minister of Food told the House of Commons recently that the average cost of North American wheat landed in this country in May was 148s. 8d. per 480 lb. Exchange, the wastage of war, coal, transport workers' wages, and many other factors affect price; but all of them together do not explain the present cost of American wheat. The great increase which has taken place in the last few months is due to a cause which has a peculiar significance for the British farmer.

In the five years ending 31st July, 1914, the principal wheat exporting countries shipped 18,000,000 metric tons of wheat.*

* A metric ton is 2,204½ lb.

Of this quantity 16,530,000 tons came from the following groups of countries:—

	<i>Tons.</i>
Canada, U.S.A., Argentina	7,800,000
Australia, India	2,800,000
Russia, Rumania	5,930,000

The total wheat crop of Canada, the United States, and Argentina in the five harvests 1909-13 averaged 28,200,000 tons. On the outbreak of war wheat growing rapidly extended, and, favoured by exceptional weather, the combined crops reached the gigantic total of 44,100,000 tons in 1915. 1916 was an unfavourable year, but the average production of the period 1915-19 was 33,520,000 tons, and last season's harvest yielded 36,700,000 tons.

Thus the American effort made up for the loss of the Russian crop. But what is the position in 1920? The United States, much the largest contributor to the total crop, has practically returned to its pre-war acreage, and although according to the June forecasts the crops are promising, the total yield expected is 22,000,000 tons, as against 25,600,000 tons last year and 18,700,000 tons in the period 1909-13.

Many other factors, such as the Argentine export duty, enter into this complicated question of wheat prices; but the present cost of American wheat appears to be chiefly due to the fact that the farmers of the United States, like the farmers of the United Kingdom, are rapidly reverting to pre-war farming: with consequences to their respective countries, be it noted, which may be very different.

Extensive Autumn Sowing essential.—The United Kingdom is the greatest purchaser of wheat (we took 5,880,000 tons per annum out of the total exports of 18,000,000 tons in the period ending July, 1914); the United States grows all the wheat she needs and a little more.

Americans went breadless to win the War, they have gone dry since the Armistice, but we cannot expect them to go hungry to oblige either the British consumer or the British producer. Our wheat supply is not their business. They will send us what they can spare, at a price. Other countries will do the same, and if seasons are propitious all will be well.

But do not let us forget that since 1914 wheat harvests have, on the whole, been good, that seasons have an unpleasant way of lapsing and that the wheat growing resources of the British Isles are undeveloped.

It is time, therefore, to cease arguing over the merits of guarantees, the dangers of low prices, the superb quality of our pastures, or the tearful propensities of our climate, and to get to work on the 1921 wheat crop.

The farmer has been delivered from the war conditions and war limitations of 1917; his labourers have returned, and he is free to select the land which, in his judgment, is best suited for wheat growing; he has had his "grouse" at the Food Production Department, its methods and its officials; now let him make his plans for autumn sowing; more than one of the chief offenders of 1917 will be well satisfied if in 1921 he beats the 1918 record.

THE PROGRESS OF AGRICULTURAL CO-OPERATION IN ENGLAND AND WALES SINCE THE ARMISTICE.

R. H. CARR,

Director-General, Agricultural Organisation Society.

ENGLISHMEN are by instinct and tradition a race of individualists, averse from combination except in the face of common dangers against which individual action is palpably of no avail, and proverbially given even then to "muddling through" rather than to systematic and well planned organisation. The communistic spirit, innate in certain other races, is singularly lacking in the English character, and there is perhaps no section of the community so markedly non-communistic as the agricultural. It is not therefore surprising that agricultural co-operation, autogenous in Denmark and some other countries, has been in this country a plant of slow and sporadic growth, and that its cultivation in the earlier stages of the movement involved the most unremitting energy on the part of the cultivators with results which were frequently disappointing and invariably patchy.

Furthermore, it follows that, the national genius being prone rather to action than analysis, the development of the co-operative movement in agriculture has received scant attention from the public and even from many of those who are most concerned with agricultural interests. Now that the movement has attained maturity—fully one-third of the farmers in England and Wales are at present members of co-operative societies—it is high time that a careful record should be compiled of its birth, boyhood and adolescence. Lecturers and students at agricultural colleges have not unreasonably complained that, whereas there is no lack of literature respecting the corresponding movements in other countries, there is no available record or text book concerning the movement in this country. It is not possible here to attempt more than a rapid and necessarily superficial survey of progress during the past few years. The Agricultural Organisation Society, however, contemplates the issue at an early date of a book which, it is hoped, will to some extent repair the omission which has been indicated.

Early Years of the Agricultural Organisation Society.—
From its formation in 1901 down to 1917 the Society was

engaged in the work of starting agricultural co-operative societies in every village and district in which the local farmers could be induced to attempt combined trading on a co-operative basis. Its attitude towards these societies when formed was naturally somewhat paternal, and, as the Report of the Society for 1917-1918 candidly declared, the government of the Agricultural Organisation Society was bureaucratic, with a lack of intimate contact between the societies and the central governing body, which automatically increased as the movement itself developed. With the limited resources at its disposal the Society could not undertake a general propaganda throughout the country, nor was it in a position effectively to co-ordinate the organisation and development of societies, and its efforts were mainly confined to following up inquiries received from localities where some person was already interested in agricultural co-operation.

The Present Policy.—In 1917 the Governing Body under the Chairmanship of Mr. Leslie Scott, K.C., M.P., resolved to divest the Society of its paternal character and to democratise it fully so that it might become the servant rather than the patron of the affiliated societies. The character of the Governing Body itself was changed by the substitution of the elective principle for that of nomination. Fifteen branch committees were set up in the provinces, composed of representatives of the local societies, and charged with the supervision of local administration. The system of referring questions of policy and principle to conferences of societies was developed, with the result that to-day the affiliated societies through the length and breadth of the country are in a position not only to determine the composition of the Governing Body, but also to decide for themselves the big questions of policy which arise from time to time.

The democratisation of the movement was naturally and rightly followed by a drastic reorganisation of its machinery. The movement itself at that stage was obviously not in a position to provide the necessary funds to meet the expense of the organisation required, but fortunately the Government found themselves able to adopt the strong recommendations made in 1917 by the Agricultural Reconstruction Committee over which Lord Selborne presided, and to provide considerably increased grants from the Development Fund for the promotion of agricultural co-operation. The Society, therefore, when the Armistice was signed, found itself well equipped to meet the anticipated demands from the agricultural community for a big

extension in co-operative organisation, and these anticipations were more than realised during the following year.

Propaganda Campaign.—The first essential was to preach the principles and expound the methods of co-operation in every agricultural district throughout the country, and a special propaganda campaign was instituted in February, 1919, in the course of which public meetings were held at all the principal market towns in England and Wales, with supplementary village meetings in the evenings in the areas where market towns were scattered and difficult of access. The actual results of this campaign exceeded the most sanguine expectations, and at its conclusion in January, 1920, the Society was able to report that some 300 propaganda meetings had been held during the year, that these meetings had recruited on the average 100 farmers a day as members of the local societies, and that fresh capital had been raised for these societies to the extent of over £300,000. During the period of just under twelve months the membership of farmers' co-operative societies in England and Wales increased by over 40 per cent., and their share capital by well over 100 per cent.

Organisation of Affiliated Societies.—The results, from the point of view of co-ordination and systematic organisation, were even more important. A careful study of the distribution, types and operations of the affiliated farmers' societies in 1918, in conjunction with the map of England and Wales, revealed the fact that societies had been started in the country without reference to each other and on no preconceived plan which would admit of proper co-ordination. Every imaginable type, from the large general trading society covering two or three counties and dealing with every aspect of its members' business, down to the village society of a dozen members co-operatively owning a single threshing machine, was in existence, and little attempt had been made to bring these scattered units together and to work out schemes appropriate to each area which could be developed so as to provide for all the needs of the local agricultural community. Many important producing areas were unprovided with any form of co-operative organisation. Others were congested with small societies competing with each other for existence. What was obviously needed was an application of the principles inherent in modern town planning, combined with an intelligent appreciation of the individual characteristics

and needs of each area, whether geographical, physical, or determined by local predilections or prejudices.

This was the main problem which confronted the Governing Body in 1919 on the side of organisation as distinct from propaganda. In each area in turn it was found that the success of the propaganda campaign was in direct proportion to the thoroughness with which the scheme of organisation had been worked out in advance. In its report for the year 1919-1920, which is on the eve of publication, the Society has been able to announce that, with the exception of Middlesex, Huntingdon, Bedfordshire, Merionethshire, Radnor and Cornwall, in regard to which important developments are under weigh, every county in England and Wales is now adequately provided with large co-operative farmers' societies extending over a wide area. In a number of cases the local societies have amalgamated to form a single county society; in others it is found preferable to carry on two or more societies under a working arrangement which provides for the definition of areas and prevents overlapping. The framework is there; the intensive development of the societies is in active progress.

The Attitude of the big Farmers.—The policy of the Society in advocating the development of large general trading societies in contradistinction to the village societies, which are so marked a feature of agricultural co-operation in Denmark and Ireland, has met with criticism, particularly from the industrial co-operative movement, whose problems are essentially different in character, and has also led in some quarters to the wholly erroneous impression that the movement in this country has been oriented in the direction of the big farmers to the gradual exclusion of small farmers and small holders. It is true that, whereas in the earlier stages the movement was mainly confined to small farmers, as under pre-war conditions the larger producers could perceive little direct advantage in co-operative methods, the greater stress of post-war conditions has induced even the biggest farmers not only to join co-operative societies for trading purposes but to take a definite lead in their formation and development.

The advantages of this change of attitude on their part are far-reaching. To the mind of the average farmer theoretical considerations and logical deductions make little appeal unless they are backed by the opinion of those whom he knows and trusts. The best propaganda speech that can be delivered at any farmers' meeting held in the cause of agricultural co-opera-

tion consists in the utterance of a single sentence from the lips of the leading farmer in the neighbourhood to the following effect:—"I used to think that this agricultural co-operation was all nonsense, but now I am going to back it and put my money into it." The small producers readily follow the lead of the big farmers, and it is noteworthy that a very high proportion of the membership of the largest and most successful farmers' societies consists of men farming less than 50 acres, and that even those societies which consisted mainly in the past of comparatively large farmers are daily increasing the small producer element, and are developing the system of local depots, with branch advisory committees, which are needed to meet the requirements of those who cannot afford to buy in truck-loads. Indeed, the small farmer must be linked up with the large farmer if he is to obtain the maximum benefit from co-operative purchase and sale, as the larger the bulked trading transaction the greater the possibility of substantial savings in cost.

Influence of the War on Co-operation.—The fact is that the agricultural community of this country is being driven into co-operative methods by the sheer force of circumstances, and is recognising the need for developing its commercial organisation on the lines which are proving most successful in other forms of business enterprise. The prodigious and necessary expansion of the wage bill, the huge increase in the cost of feeding stuffs, fertilisers and other raw materials, and perhaps more than all the new consciousness on the part of the consumer of his rights as a consumer and of his difficulty in coping with the high cost of living, have forced the farmer to realise that he can afford to neglect no means of cutting down the cost of production or of effecting savings in the handling, distribution and marketing of his produce. The root causes, therefore, of the extraordinary growth of the co-operative movement during the past twelve months are to be traced to conditions which arise directly out of the changes effected by the War, and the Agricultural Organisation Society does not claim more than the provision of a well-planned lay-out and effective machinery, for which the motive power has been supplied by the farmers themselves.

England v. Denmark.—The historian of the future will perhaps be more interested in examining the defects which the spread of agricultural co-operation has revealed than in describing its actual growth and development, and indeed the diagnosis and remedial treatment of these defects is essential to the health of

the movement at the present time. Those who are most closely acquainted with agricultural co-operation as practised in Denmark will perhaps be surprised to learn that the most salient need of the co-operative movement in England and Wales is capital. In Denmark, where the dual system of landlord and tenant has given way to that of the owner-occupier, and the farmer consequently is in a position to borrow capital on ample security, co-operative societies make no demand upon their members for share capital and have proved themselves able to flourish on borrowed money pending the accumulation of adequate capital out of profits effected by savings in the conduct of their business. It is sometimes forgotten that capital accumulated in this way is gained at the expense of the farmer members, who have to pay more for their raw materials or receive less for their produce, as the case may be, in order that the interest on the borrowed capital may be paid and that a sufficient margin may be carried by their society to reserve. The Danish farmers are consequently providing capital by a system of deferred payments.

In this country, on the other hand, where the average farmer can provide his society with no security on which money can be borrowed, and where the banks are, rightly or wrongly, less accommodating than in Denmark, the conditions of co-operative trading approximate more closely to those under which ordinary commercial businesses are conducted, and the provision of adequate capital for working purposes, no less than to cover the provision of buildings and equipment, is essential to the development of a successful co-operative society. A committee of farmers with little previous experience of organised commerce is naturally apt to underestimate the proportion of working capital required for trading purposes, and it too often happens, also, that when a difficulty is encountered in raising the full amount required to start a society on the proper lines the promoters are tempted to begin with too little capital and to rely overmuch on borrowed money.

The Agricultural Wholesale Society.—Apart from the question of finance the main desideratum in the co-operative movement at the present time is to secure better cohesion not only between the societies and their individual farmer members, but also between the societies themselves. The individual farmer is still too ready to forego the ultimate advantages of co-operation in his anxiety to make an immediate profit, and is constantly liable to fall an easy prey to temporary undercutting on the part of

a competing trader. The societies, also, have not yet fully grasped the value of combined purchasing and selling through their central trading organisation, the Agricultural Wholesale Society. There is evidence of a marked improvement in this respect in the fact that the turnover of that society increased from £276,000 in 1918 to nearly £2,000,000 in 1919, but even that figure represented barely 20 per cent. of the total turnover of the affiliated societies in the commodities which the central society is in a position to obtain for them. The whole of the shares of the Agricultural Wholesale Society are held by affiliated co-operative societies, so that it is in fact as well as in theory the central trading federation of the societies, and not an independent organisation of whose services they may or may not avail themselves.

Co-operative Disposal of Produce.—As this country is not an exporter of agricultural produce, and has built up in the course of generations a highly developed system of internal markets, it is natural that the co-operative movement has made more progress in the combined purchase of the raw materials of farming than in the disposal of produce. Nevertheless, in certain directions this aspect of the business is now developing rapidly. The combined turnover of the co-operative dairy societies in England and Wales last year in milk and milk products approximated to £5,000,000, and now that the dairy industry is decontrolled and State restrictions have been removed a remarkable expansion of the co-operative movement in dairying is in progress. The co-operative handling of home-produced wool is being carried out this season on broad lines which will enable the farmer through his society to place his wool direct on the world's markets and to obtain full value for it. The latest returns indicate that not less than 200,000 fleeces, collected, weighed and classed by the co-operative societies, will be sold on the London wool market during the next few months. The disposal of home-grown meat, also, is being revolutionised through the gradual adoption by the farmers of the dead weight system, under which their cattle, sheep and pigs are slaughtered at co-operative abattoirs and sold to the best advantage in local markets and in the big consuming centres. There are now some 25 such co-operative abattoirs in full working, extending from Berwick-on-Tweed to the borders of Cornwall, and arrangements are far advanced not only for marketing the meat and edible offals but also for converting inedible offals and waste into valuable by-products such as fertilisers and feeding stuffs.

Relationship between Producer and Consumer.—It is not unnatural that some of those who have watched the development of agricultural co-operation in this country during the past two years have expressed anxiety lest the movement, in advancing the interests of the farmer, should be directed against those of the consumer. The exploitation of the consumer has at no time been a feature of the co-operative policy, and, indeed, any attempt in that direction would necessarily defeat itself. High prices and restriction of output are as dangerous to the producer as to the consumer, and the real object of the farmer is to organise the purchase of his materials and the disposal of his produce in such a way as to enable him safely to increase his production and work his land to its utmost capacity. The co-operative system brings him nearer to the consumer, and so tends to their mutual advantage.

Co-operative Movement and Allotment Holders.—One of the most striking developments of the agricultural co-operative movement during the past few years has been the phenomenal growth of the organisation of allotment holders. There are now upwards of 1,000 allotment societies affiliated to the Agricultural Organisation Society, nearly all of which are registered under the Industrial and Provident Societies Acts. The object of these societies is to acquire land for their members either by renting or by purchase, to carry on a co-operative trading business for the purpose of supplying their members with seeds, fertilisers and tools, and in many cases disposing of their surplus produce, and to regulate the cultivation and arrangement of the individual plots. Unorganised allotments are usually an eyesore to the community, but this can easily be avoided by careful planning and the enforcement of a few simple regulations. The co-ordination of the interests of allotment holders with those of the larger producers under the aegis of the Agricultural Organisation Society has had the happiest results, and is conducing towards a better mutual understanding of the problems and interests of town and country which is of real national benefit.

Co-operative Movement and Small Holders.—The organisation of the small holders, so far as concerns those who are dependent for their living on their farming operations, is a different and, in some respects, more difficult problem. The development of small holdings was necessarily retarded by the War and, as respects civilian applicants for holdings, is still at a standstill. The settlement of ex-service men on the land is proceeding

steadily, and wherever these settlements include a sufficient number of holders to justify concerted action, co-operative societies are being formed to undertake the supply of requirements and the marketing of produce. Isolated small holders are encouraged to join the farmers' societies. In the latter case no difficulty is experienced in obtaining effective service, but the societies that are composed exclusively of small holders are often hampered from turning their produce to the best advantage by the lack or cost of adequate transport facilities, and progress in this direction must necessarily be slow until a radical improvement is effected in the transport system of the country.

The tide will not turn in the agricultural co-operative movement, which is now firmly established as the natural business agent of the agricultural community. The fortunes of individual societies will vary in accordance with the degree of foresight, prudence and imagination exercised by those who are responsible for their direction, with the efficiency of their actual management, and with the loyalty and financial backing of their members: but the future of agricultural trading in this country now rests with the producers themselves.

THE WORK OF AGRICULTURAL EXECUTIVE COMMITTEES SINCE THE ARMISTICE.

AFTER the Armistice, when the compulsory breaking up of grass land ceased, Agricultural Executive Committees devoted their energies to the task of levelling up and improving the general standard of farming in their respective counties. The Committees retained, and still retain, all the powers that were exercisable by them during the War under the Defence of the Realm Regulations, but for the last eighteen months Cultivation Orders have been served only where the rules of good husbandry were not being observed, or where in other respects land was being neglected; for example, in regard to the maintenance of dykes and drains.

Enforcement of Cultivation Orders.—Cultivation Orders usually specify a date by which the work is to be completed, and where the work is not carried out, the defaulter may be prosecuted if the authority of the Ministry be obtained.

Among interesting cases where legal proceedings have been taken are the following:—

(i.) In East Suffolk 33 acres of good corn-growing land were bought in 1918, and the purchaser turned out the tenant, a good farmer, after asking a rent which was more than the land was worth. The land was then allowed to lie idle and become derelict, in spite of the service of Cultivation Orders by the Agricultural Executive Committee. The owner was therefore prosecuted for failure to comply with the Orders, and fined £20, or, in default of payment, six weeks' imprisonment.

(ii.) A notice to plough six acres of land was served on a farmer in Worcestershire in August, 1919, but no action had been taken by him up to February, 1920. It was shown that the land had lain derelict since the 1918 harvest, and about £80 worth of food was lost to the nation. The defaulter was prosecuted and fined £10 and £2 2s. costs.

(iii.) An owner of land in Somerset was prosecuted for failing to comply with a Cultivation Order served in June, 1919, requiring the land to be ploughed and cleaned by the 2nd September. The defendant's solicitor pleaded guilty on behalf of his client, but urged in extenuation of the offence that the land was purchased with the object of selling it again, not with the intention of cultivating it, and that delay had occurred in

finding purchasers suitable to his client. The Bench imposed a fine of £25, with £10 10s. costs.

(iv.) A prosecution for disregard of Cultivation Orders issued by the Surrey Committee resulted in the occupying owner of the land being fined £50 and his agent £10. The Orders in question were issued in October and November, 1918, and required that certain arable fields should be cleaned and cultivated in preparation for food crops for the harvest of 1919. Practically nothing was done, however, to carry out these Orders up to the end of 1919.

(v.) An occupier of a field of 23 acres in Kent was recently prosecuted for failure to comply with a Cultivation Order. The field contained a large quantity of thistles, brambles, gorse and anthills, which the occupier was instructed to remove and destroy. The thistles were dealt with, but very little action was taken to remove the other rubbish which encumbered a large proportion of the field. The defendant was fined £20 and £5 5s. costs, and has been served with a further Order to carry out the necessary work.

The problem of farms bought by speculators presents great difficulty, as Cultivation Orders have to be served on the "occupier," and in cases where the land changes hands frequently it is not always easy to ascertain who is legally the occupier at a particular time, in order to serve him with the notice.

Several prosecutions for failure to clean ditches have taken place in Norfolk. In one case the Order was served in May, 1919, and had not been complied with by March, 1920, and the defendant was fined £10 and costs. In another case the neglected ditch contained poison in the form of deadly nightshade, by which a horse and two young cattle were killed. A fine of £5 4s. was imposed.

There is no record of the total number of Cultivation Notices served by Agricultural Executive Committees, but it amounts to many thousands, leaving out altogether "Grass-ploughing Orders," which were served with the express object of increasing the arable acreage as a war measure.

Determination of Tenancies.—Under Article (1) (f) of Regulation 2M, the Ministry may determine the tenancy of an occupier of land who by reason of incompetence or persistent neglect shows that he cannot make proper use of his land. This drastic step is only taken after repeated warnings, and usually

after several Cultivation Notices have been served without effect. The notice may be nullified if, on appeal by the tenant to arbitration on the question whether the holding has been properly cultivated, the arbitrator takes the view that it has been. It is of interest that out of 20 cases where the tenant exercised his right of appeal the decision was against the tenant in every case. The total number of Determination Notices issued since January, 1917, is 809, relating to an area of 61,000 acres. The following may be quoted as examples:—

(i.) A farm of 19 acres in Buckinghamshire was under observation for a considerable time, there being gross and studied neglect on the part of the tenant. In 1918 part of the farm was ploughed up, the work being carried out by horses and men supplied by the Agricultural Executive Committee, and the resultant crop of oats was stated to be the best crop seen in the district. No preparations were made by the tenant to harvest the crop, and on being asked whether he required assistance he replied that he was not going to have the oats cut. Subsequently he allowed his cattle to stray in the field while the crop was still standing, and he was convicted and fined under the Growing Corn (Crops) Order, 1917. The 1919 crop was a failure, and this was apparently due to the unhusbandlike manner in which the lands were cultivated. The Ministry accordingly issued an Order determining the tenancy of the farm in February, 1920.

(ii.) The tenant of a farm of 150 acres in Worcestershire was served with Cultivation Orders, which he ignored. An independent report showed that the greater part of the arable land had not been ploughed for a considerable period, and that the grass land, which was poor, needed manuring. The tenancy was determined in February, 1920.

(iii.) In Northamptonshire the tenancy of a farm of 242 acres was determined about the same time. In this case the pasture land was badly grazed, and not one of the four hay stacks had even a layer of straw to protect it. The 1919 crop had not been threshed, and the arable land generally was in a deplorable condition. The fences and ditches were also in a bad condition. The occupier required the notice to be referred to arbitration, and the arbitrator found that the farm had not been cultivated according to the rules of good husbandry; the appeal therefore failed.

(iv.) Two holdings were let to a farmer in Derbyshire. Cultivation Orders were served upon him in respect of one of the holdings, but the tenant, who had taken the holding early in

1919, had sold the crops standing and made no attempt to cultivate the land. The Committee secured the conviction of the tenant for failure to comply with one of the Cultivation Orders, and also determined his tenancy. In the other case the prosecution was withdrawn.

(v.) The arable part of a farm of 81 acres in Herefordshire was found to be in a foul condition, fences and ditches were bad, and the greater part of the farm was in a neglected state. The tenant did not appear to be capable of improving the cultivation of the land, and the tenancy was therefore determined.

(vi.) The tenancy of five fields in the West Riding of Yorkshire was determined owing to the neglected condition of three arable fields comprised in the holding. The tenant had had several Cultivation Orders served upon him, and received many warnings, but he persistently refused to make any attempt to improve the cultivation.

(vii.) In September, 1918, a Cultivation Order was served on the occupier of a 216-acre farm in Buckinghamshire. It was practically ignored, and much of the land was found in March, 1920, to be in a foul condition, with the ditches in great need of attention. An Order was issued determining the tenancy, owing to the land not having been cultivated according to the rules of good husbandry.

(viii.) An Order determining the tenancy of a farm of 105 acres in Flintshire was issued in February last. The occupier held another farm, and had allowed this one to get into a deplorable condition. Couch grass and weeds had been mown and made into hay, there had been no attempt to cultivate the land, and the fences had been neglected for years. The occupier appealed to arbitration as to whether the farm had been cultivated according to the rules of good husbandry. The award was against him, and he had to pay the costs.

(ix.) Another instance in Wales was that of a farm of 262 acres in Glamorganshire, which was described as thoroughly foul, and on which the fencing was so defective that the stock wandered from field to field, damaging growing crops.

Entry on Lands.—In some cases, where no other course seemed possible to ensure proper cultivation, Committees have entered into possession of land and either farmed it themselves or let it to tenants. An article describing typical examples of action on these lines appeared in the issue of this *Journal* for June, 1919, and an account of the general results appeared in the April issue of this year, as well as a note in the March

number describing those farms which were cultivated entirely by women of the Land Army.

Where satisfactory arrangements can be made for future cultivation, the land taken over under Regulation 2M is being relinquished, while in other cases the farms are being used as training centres for ex-Service men. In a few instances the land has been acquired for purposes of land settlement, and in Worcestershire one farm taken over and brought into a good state of cultivation by the Agricultural Executive Committee is now being utilised as a Farm Institute in connection with agricultural education.

Special difficulties are being experienced in connection with derelict building estates taken over in Essex, Kent and Sussex. These consist of areas of agricultural land which have been sold in small plots for building purposes, but have never been built upon. Much land of this kind was taken over during the War and brought back to cultivation after many years of neglect. Isolated plot holders are now applying for the release of their plots for building, and owing to the shortage of houses and the compensation that would be payable if these plots were retained contrary to the wishes of the owners, the policy of the Ministry is to vacate such of the land as is required immediately for building. Great difficulty must inevitably result in carrying on the cultivation of the rest of the land when isolated plots, with the necessary access, are relinquished.

One such building estate in Sussex has produced remarkable crops, although at the time of entry by the Committee in 1917 it was practically derelict. There are no farm buildings, and the cultivation has been carried on with excellent results under very adverse circumstances. It affords a striking example of success in continuous corn cropping with the abundant use of artificial manures, and great credit is due to the Executive Committee and its officers for their skilful management of the enterprise. Owing to the demand by many of the plot-owners to have their land back in order to build on it, this estate is to be relinquished after the growing crops have been harvested.

The difficulties experienced by Agricultural Executive Committees in dealing with cases of gross negligence and incompetence are exemplified by a case in Durham. This farm was in a notoriously dilapidated condition, neither the owner nor the occupier (both of whom resided in the farmhouse) being capable of farming it properly. The service of Cultivation Notices had not the slightest effect, although the tenant was prosecuted and fined for negligence. The Committee also made unsuccessful

efforts to persuade the owner to let the farm to a capable tenant, and finally, with the approval of the Ministry, took possession of the land and began to cultivate it, the owner and occupier being left in possession of the farmhouse. The owner and occupier obstructed the Committee and threatened violence, and for this they were summoned and each fined £25 and £10 costs. The land has now been let by the Committee to a tenant who has made good progress with the cultivation.

A farm of 216 acres in Kent was taken over early in 1917 in a deplorable condition, having been occupied by a tenant with no knowledge of farming. The tenant was allowed to remain on the farm as foreman under the instructions of a supervisor appointed by the Committee, and the Ministry's technical expert reported in August, 1918, that a "marvellous transformation" had taken place in the cultivation, in spite of the handicap of an inefficient foreman. The tenancy was subsequently determined, and the farm is still in the hands of the Committee.

In Warwickshire a farm of about 450 acres was taken in hand in 1917. 300 acres had not been farmed for thirty years, and the land was overgrown with thorn bushes and infested with rabbits. Prisoner of war labour was obtained, and under the efficient management of a member of the Executive Committee the whole farm was brought into a good state of cultivation. It has recently been sold, and out of the purchase money the Ministry has by arrangement been paid the sum of £2,400, which will go to recoup the money expended in reclaiming and cultivating the land.

Very successful results have attended the cultivation of a large area of derelict glebe land in Cambridgeshire. The proper treatment of this land was rendered very difficult by the absence of buildings, and the land was overgrown with bushes and required a great deal of labour to bring it into cultivation. This has now been accomplished, and excellent crops of corn have been grown.

In this and other cases where Agricultural Executive Committees have cultivated derelict land, the value of their work has consisted in a large degree in exemplifying the practical application of scientific and up-to-date principles to the management of neglected and naturally poor land.

Members and officers of Agricultural Executive Committees have given much time, as well as practical knowledge and ability, to the task of making a success of what has been, in many cases, a somewhat hazardous experiment, and it is confidently hoped

that their labours, begun under the difficult conditions which prevailed during the War, will have a permanent influence in raising the standard of cultivation in the districts where the possibilities of improvement have been demonstrated in a practical way.

It may be added that the area of land still in possession of Agricultural Executive Committees is about 32,000 acres, of which 20,000 acres are farmed direct and 12,000 acres are let to tenants. A great part of the land will be given up next Michaelmas. The Agricultural Executive Committees, as such, will shortly disappear, and the powers which they now exercise on behalf of the Ministry will be transferred to the County Agricultural Committees that have been recently set up under the Ministry of Agriculture and Fisheries Act, 1919.

FARMYARD MANURE: ITS MAKING AND USE.*

Nor many years ago it used to be the custom for certain representatives of agricultural science to extol the virtues of artificial manures, while farmers, on the other hand, stoutly maintained the superiority of farmyard manure. In recent years the position has changed. It is now the scientific worker who emphasises the importance of farmyard manure and the need for making and storing it properly. Farmyard manure and artificial fertilisers do not compete with one another; they serve quite different purposes in the soil. No farmer can do without artificials, no matter how much farmyard manure he may have at his disposal, and, conversely, no arable farmer, except in a few special districts, would like to do without farmyard manure, even if he could have unlimited supplies of artificials at very low prices. The best results are always obtained on arable land by proper combinations of farmyard and artificial manures, although on grazing land farmyard manure may not act well.

So far as is at present known, the effects produced by farmyard manure in the soil are three:—

1. To supply nitrogen and potash to the plant.
2. To improve the physical condition of the soil, and thus increase its capacity for going into a good tilth and for holding water. The effect of this is to steady the yield.
3. To assist some of the micro-organisms of the soil; among other effects, to benefit the clover crop.

Only in the first of these is there any competition with artificial fertilisers, and even here the competition is restricted, because artificials usually exert their full action on the crop to which they are applied, while farmyard manure does not.

The Constituents of Farmyard Manure.—1.—*The Excretions.*—The animal excretions constitute an important part of the fertilising material of farmyard manure. The urine is by far the most important—it is the chief source of the immediately beneficial part of the dung. The amount and value of the urine depend on the food and on the animal; urine contains the fertilising constituents of all the digested food which has neither been retained in the animal nor secreted in the milk.

Its composition can be calculated, and this is done in determining the manurial value of foods, but the calculation never

* Reprint (abridged) of a paper read by Dr. E. J. Russell, F.R.S., Director of Rothamsted Experimental Station, at a meeting of the Farmers' Club, 31st May, 1920.

comes out quite right, because its valuable constituents are so easily decomposable that they are readily lost.

Although the dry matter of the urine forms only about 2 per cent. of the actual weight of the dung, it constitutes a much larger proportion of the weight of fertilising materials. A ton of dung contains about 12 to 15 lb. of nitrogen, of which about 4 to 9 lb., according to the amount of cake and corn fed, would come from the urine.

2. *The Litter.*—Straw is by far the commonest litter, and it forms the chief part, by weight, of farmyard manure. Broadly speaking, one ton of straw makes 4 tons of farmyard manure, but the additional 3 tons is very largely water, only a small part being other excretory substances. Of 100 parts of farmyard manure made in a bullock yard:—

75 are water.

About 2 are solid constituents of the liquid excretions.

About 8 are constituents of the solid excretions.

About 15 are constituents of the litter.

On the basis of bulk, therefore, litter is more important than anything else, although not in other respects. Its chief effect is that it forms the humus in the soil, and therefore helps to promote tilth and to improve the water-holding capacity. Unfortunately, its change into humus is expensive to the farmer in that the organisms effecting the change take up valuable nitrogen compounds from the urine that ought to have gone to feed the crop.

The Making of Farmyard Manure.—The simplest case is that of manure made from fattening bullocks in stalls or covered yards where the manure is of considerable value, and where pains are commonly taken to preserve it. Of every 100 lb. of nitrogen fed to the animals, about 95 lb. pass into the manure—often about 45 to 60 lb. in the liquid and 50 lb. to 35 lb. in the solid excretions. The 45-60 lb. are in a form highly valuable to the plant. The decomposition process, however, takes rather a heavy toll, in one way or another about 15 lb., leaving 30 to 45 lb. in a form really useful to the plant. The nitrogen in the solid, and such of this 15 lb. as is not altogether lost, may at some time become useful to the plant, but it does not count for much: only the 35 to 40 lb. balance can be relied upon to yield any profit.

When, as often happens, the manure is made in open yards, the loss becomes more serious. The minimum loss of 15 per cent. is exceeded, often much exceeded, and, as always, it falls

on the most valuable part of the nitrogen. It is probably not far wrong to suppose that the manure from a bullock receiving 3 lb. of cake and upwards per day is worth 15s. or more per month when made in a covered yard, but not more than some 10s. or 12s. per month when made in an open yard. For a herd of twenty bullocks, the loss in manurial value through having no roof to the yard may be any amount up to £5 per month.

It is often maintained, however, that some rain is necessary, as otherwise the manure becomes too dry. While a certain amount of moistness is necessary, rain may seriously damage the manure by washing out some of its valuable constituents and by bringing about certain undesirable changes. It is probably better to keep rain away from the manure and to ensure sufficient moisture by reducing the area over which the animals can wander, thus obtaining a high proportion of excretions among the litter. The comfort and well-being of the animals, however, must always be the first consideration. Periodically pumping liquid manure or water over the heap is not to be recommended.

Storage of Farmyard Manure.—In the matter of storage the Northern farmer has some advantages over his colleagues in the South, one of which is that he can, as a rule, advantageously apply farmyard manure to his land in the spring. Manure made in the yards during winter can thus be hauled straight on to the land and ploughed in with reasonable certainty that this is the best thing to do. The Southern farmer, on the other hand, while he may be driven to spring applications of farmyard manure, would often obtain better results by applying the manure in the autumn. The storage of farmyard manure over the summer months thus becomes an important question.

However carefully matters are arranged, directly the manure is drawn from the yards some of its really useful nitrogen—the 30-lb. balance—begins to leak away. It forms part of the odour that gave the old farmers so much satisfaction. It enters largely into the black liquid, which, even in a well-conducted farm, is often seen draining away from the manure heap. Both smell and liquid are signs of leakage; but they do not represent the whole of the loss. It is wrong to suppose that matters can be put right by simply replacing the black liquid; its very existence is a symptom that bigger losses are taking place.

Many attempts have been made to obtain a reliable estimate of the amount thus lost. In experiments at Rothamsted the losses varied from 7 per cent. to 35 per cent. of the total nitrogen. A common loss was about 20 per cent., falling chiefly on the urine

nitrogen. Assuming this latter figure were generally true—and we have no reason for supposing otherwise—our 30 lb. of valuable nitrogen would soon be reduced to little more than 10 lb.—i.e., 33 per cent. of the original nitrogen, or 75 per cent. of the most valuable portion, has disappeared.

Loss in Farmyard Manure.—It has often been suggested that kainit, gypsum, superphosphate, or other substance added to the manure helps to reduce the loss by fixing ammonia. The processes bringing about the loss, however, are too complex to offer any reasonable expectation of the discovery of a satisfactory fixer.

It is difficult to form any estimate of the loss which occurs to farmyard manure over the whole country, but it must be considerable. Taking the present consumption of straw in the farm buildings of the United Kingdom to be about 10,000,000 tons per annum, the production of farmyard manure would be 40,000,000 tons, worth at present prices some £25,000,000 or more. The loss in making and storing the manure heap is not less, but probably more, than 20 per cent. of this, i.e., more than £5,000,000 each year.

This loss cannot altogether be avoided, because it is part of the cost of the necessary decomposition of the straw, but it can be much reduced. In experiments at Rothamsted the provision of shelter to keep off some of the rain much increased the effectiveness of the heap.

Shelter can be provided in several ways. A layer of earth has proved effective, but it is not always convenient. Straw-thatched hurdles acted well in the trials. Placing the heap in a well-sheltered position is also helpful.

At present prices it is probably safe to suppose that an amount from 1s. to 5s. is added to the value of every ton of manure by providing shelter.

The Feeding of Cake.—There has been considerable discussion as to the extent to which cake-feeding adds to the value of farmyard manure. In recent experiments the additional value due to the cake was less than was expected, and the benefit of the cake was shown only in the first year, and not afterwards. The practical man, however, holds fast to cake-fed dung, and recent experiments at Rothamsted have shown a direction in which it may be superior to ordinary dung. The breaking up of the litter to form humus is brought about by organisms which require the sort of nitrogen compounds that they would find in cake-fed

dung; they would, therefore, be able to work more vigorously in cake-fed dung than in ordinary dung, and hence would tend to produce better soil conditions.

The evidence indicates that cake feeding produces less benefit than might be expected on soils where plant food only is needed, but more benefit on soils where additional humus is necessary.

Cow Manure.—The question of cow manure is complicated by the necessity for satisfying sanitary inspectors, and by the fact that it is of poorer quality than bullock manure.

The poverty of cow manure arises from the fact that a cow secretes a considerable proportion of the nitrogen of the digested food in the milk instead of passing all of it into the urine like a bullock. The urine is, therefore, weaker than in the case of bullocks, and there is a corresponding reduction in the value of the manure.

On some of the Oxfordshire farms a big covered shed is built next the cattle-shed for the storage of manure. The principle is sound, but the plan is sometimes inconvenient in execution. In Cheshire one sees good dungsteads—roofs of corrugated iron carried on stout posts, and so placed that the dung can easily be tipped underneath and then compacted. These are of great value, but care must be taken that the manure is sufficiently well compacted to prevent it becoming too dry.

Cow manure, however, presents an interesting possibility, because so much of the liquid is or can be collected separately, and this should certainly be done wherever practicable. The liquid is very valuable, containing as a rule about 18 lb. to 23 lb. of nitrogen per 1,000 gallons, besides possessing a high potash value.

A suitable dressing is 1,500 gallons per acre, and it serves excellently for seeds and as a spring application for winter oats or winter wheat. On an average each cow contributes about $1\frac{1}{2}$ gallons of urine per day,* which is worth about 2s. 6d. per month. The difficulty at present is to apply this material.

Artificial Farmyard Manure.—As the bulk of farmyard manure is litter, and the valuable part of the residuc is largely made up of liquid excretions, it is not difficult for the scientific investigator to make an artificial farmyard manure from straw and artificial fertilisers. This has been done at Rothamsted, and one or two tons of the product were tried on the field. It is

* Both at Woking and at Garforth, however, Collins gives 5 gallons containing 4 lb. of dry matter as the figure for the north.

too early as yet to say whether the material will work out economically in practice, but the principle is sound; it consists in allowing the straw to decompose with formation of humus, and supplying the necessary nitrogen compound in the form of an ammonium salt. When the details are worked out the method may probably prove of interest in districts like the Rothings, in Essex, where quantities of straw are produced but no live stock is kept, and yet where farmyard manure ought to be used.

Possibilities of Improvement.—The possibilities of improving bullock manure lie in the following directions:—

1. To make it in a covered yard, having sufficient beasts to keep the manure moist.
2. To put it into the ground as soon as possible after the beasts are removed; but, if this is impossible, to make a tight clamp and provide some shelter by a layer of earth or by some other device.
3. To avoid washing by rain or exposure to weather.

The defects of the clamp, even when compacted and sheltered, are recognised, and science has not yet said the last word as to the storage of manure; but for the present it is the only practicable method.

The improvement of manure from cowsheds can be effected:—

1. By collecting the liquid separately in a cement tank.
2. By storing the solid in a covered dungstead, to which can also be added manure from the horses. It is necessary to compact the heap. Provision must also be made for a tank to collect drainage.

The application of the liquid to the land, however, is a difficult problem. The method of distributing the liquid over the farm by means of pipes has been tried, but has resulted in financial loss. Something can be done by delivery from carts, but the most helpful line is the use of absorbents, which is now being investigated at Rothamsted. This is an important problem, and it will grow in importance if the soiling system of keeping dairy cows develops in this country.

THE DECLINE IN SHEEP BREEDING.

SIR HENRY REW, K.C.B.

*THE subject I am invited to bring before you for discussion is that of "the depletion of the breeding flocks of the country and the lessened production of cereal food resulting therefrom." That is a practical subject, and I need not say that I have no pretension to speak upon it from a practical standpoint. But the subject also involves the consideration of statistical facts and economic tendencies to which I have given some attention, and it is to these that I shall confine myself in the hope that they may be of some help in the subsequent discussion.

Decrease in Numbers.—It is a sound principle—not invariably adopted in public controversy—to ascertain the facts before drawing conclusions. That there has been a reduction in the number of sheep in this country is notorious; but it is desirable at the outset to obtain some measure of its extent. The agricultural returns which are collected annually in June afford the only measure we have, and they give us the number of sheep in the country year by year for over fifty years. If we summarise these returns in quinquennial periods we find that the total stock of sheep in Great Britain has varied as follows, the numbers representing millions:—

1870-4	...	...	28.6	1895-9	...	...	26.6
1875-9	...	...	28.4	1900-4	...	...	25.9
1880-4	...	...	25.3	1905-9	...	...	26.3
1885-9	...	...	25.8	1910-4	...	...	25.4
1890-4	...	...	27.6	1915-9	...	...	23.7

Leaving out of account the war period, which we will consider later, these figures would seem to indicate not only that the flocks of the country after the disasters of the early "eighties" never recovered the position which they held in the "seventies," but that during the present century they had fallen substantially below the standard of the "nineties." There is, however, a disturbing element which materially affects a comparison over a long period of returns which represent the enumeration at a fixed date each year of the total number of sheep then living. The age at which sheep are slaughtered is on the average now consider-

* An address delivered at the Darlington Conference of the National Sheep Breeders' Association on 29th June, 1920.

ably less than it was fifty years ago. The four-year-old wether which used to represent the highest standard of mutton production is now very seldom seen at table, and probably would not be appreciated by the present generation if it were. Early maturity has been adopted as a principle which suited at once the interest of the producer and the taste of the consumer. It is evident, however, that with the progressive adoption of this principle the number of sheep returned each year would decrease, even although the actual number bred were maintained. Since 1893 the annual returns have given the number of breeding ewes separately from other sheep. The average numbers of ewes so returned during the past 25 years, in millions, were :—

1895-9	...	...	...	...	10.0
1900-4	...	...	...	...	10.1
1905-9	...	...	...	...	10.3
1910-4	...	...	...	...	10.1
1915-9	...	...	...	...	9.6

It will be seen that the breeding flock in the five years before the War, though showing some decline as compared with the preceding five years, had been fairly maintained at the level of the ten years previous. In fact, if the returns are examined year by year it appears that the number of breeding ewes in each of the three years 1908-10 was higher than in any year for which we have records, and that although the number fell from a maximum of 10,810,000 in 1909 to a minimum of 9,618,000 in 1913, there were signs of recovery when the War broke out, and one-half of the loss had been made good by June, 1916.

Effects of the War.—This brings us to a consideration of the effects of the War upon sheep-breeding and to the question as it now confronts us. The returns for June, 1914, represent the pre-war position, and it will be useful to state the figures for that year and for each succeeding year up to 1919, the returns for the present year being not yet available.

The number of breeding ewes and of other sheep, with the total returned for Great Britain in each of these years, the figures again representing millions, were :—

	<i>Ewes.</i>			<i>Other Sheep.</i>			<i>Total.</i>
1914	9.8	...	14.5	...	24.3
1915	9.9	...	14.7	...	24.6
1916	10.1	...	14.9	...	25.0
1917	9.9	...	14.1	...	24.0
1918	9.5	...	13.9	...	23.4
1919	8.6	...	12.9	...	21.5

Up to June, 1917, there was no cause for alarm, as although there had been a reduction of a million in the total, the breeding flock had been but slightly affected, and was indeed slightly larger than in 1914. The serious depletion commenced after June, 1917, and in two years the total number of sheep declined by 10 per cent. and, what is more ominous, the breeding ewes decreased by over 18 per cent.

I have already indicated that the number of sheep in the country has always been subject to considerable fluctuations, attributable to the effect of season on the lambing and on the supply of keep, to the trend of prices for mutton and wool, and sometimes to the outbreak of disease. In the two years 1879-81, for instance, we lost $3\frac{1}{2}$ million sheep, mainly as the result of bad seasons and disease. But it is evident that we must look further for the cause of the losses since 1917.

There are three factors to which the recent decline of sheep breeding has been attributed; all of them are exceptional and are due to the War.

- 1.—Special economic conditions.
- 2.—Control of prices, distribution and sale by the State.
- 3.—Extension of arable cultivation.

Control.—Abnormal economic conditions arose, of course, as soon as war broke out in 1914, and farming difficulties commenced early in 1915, when the shortage of labour and increased cost of feeding stuffs began to be felt. These difficulties progressively increased and became no doubt substantially greater after June, 1917, than before. It was, however, at that period that the two other factors were introduced. The "plough policy" began to operate in the early part of 1917, maximum prices for mutton were fixed in September of that year, and in January, 1918, the official control of the sale and distribution of sheep commenced.

I do not propose to discuss the details of the control imposed by the State on the sheep-breeding industry. The system adopted was, of course, subject to some criticism on the ground that it might have been carried out in a different way with better advantage and less disturbance. Any system of the kind hastily improvised and necessarily entrusted to a large number of individuals temporarily engaged in administrative work of a novel character must in any case have had defects. Possibly experience might in the course of time have suggested improvements in detail and a better system might have been evolved. It is well, however, to be quite clear on this point and to recog-

nise that under the most perfect administrative system of control which could be devised the fundamental fact remains, that State limitation of prices and official control of distribution means, and must inevitably mean, the discouragement of breeding. In saying this I do not suggest that State control was unwise or was not required in the national interests under the circumstances of the time. The decision to fix maximum prices was a political decision, and in the case of sheep it was considered that official control of supplies and distribution was consequential on the fixing of maximum prices. I am not attempting to argue that issue, but it seems to me highly important to realise that any attempt to justify the system on the ground that it tended to maintain home supplies must fail.

I am well aware that the intervention of the State for the object of maintaining our flocks and herds was advocated, not only by the public, but even by farmers themselves at various times during the War. Pressure to take action in this direction and for this purpose began even in the autumn of 1914, and was very persistent in 1915 and in later years. In regard to the sheep-breeding industry the demand for restrictions on the slaughter of lambs or of ewes was from time to time clamorous. No doubt such demands had a plausible aspect to those who took only short views. But they overlooked the real point on which the maintenance of breeding depends. The question which determines whether the sheep stock of the country (apart from seasonal and accidental fluctuations) will increase or decrease is the decision of flockmasters every year as to the number of ewes they will put to the ram. If by some arbitrary decree they are compelled to sell off fewer sheep at a certain age or at a certain time than they would otherwise have done in the ordinary conduct of their business, their plans for making up the ewe flock will be altered, and the net result over the whole country will be that fewer ewes will be put to the ram and the stock of sheep will be consequently reduced. The fact is, that from the point of view of maintaining the flocks of the country the State must do one of two things—it must either leave the business alone or control it altogether. If the State chose to take over the management of all the flocks, with all that this implies, it could then determine—regardless of economic considerations—how many ewes should be put to the ram each year, and thus control production, so far as Nature allows. But unless it is prepared to do this the control of prices and of distribution must in the long run reduce the number of sheep kept.

Comparison of Decline in Grass and Arable Districts.

Whatever may be the causes of the serious reduction in the number of sheep which we are considering, it is clear that their effects have been much more marked in some districts than in others. Speaking generally, the arable counties have lost most heavily. Without going into details for each county it will suffice to compare the returns for two groups of half a dozen representative arable and grass counties. For the arable group let us take Cambridge, Essex, Lincoln, Norfolk, Suffolk, and the East Riding, in each of which the proportion of arable is between two-thirds and four-fifths of the farmed land. For the grass group let us take Hereford, Leicester, Northumberland, Somerset, Stafford and Warwick, in each of which the proportion of arable is one-third or less. So as to get a broad view let us take the year 1912, when the total number of sheep in the country was just over 25,000,000 and the breeding ewes 10,120,000. This represents a fair basis, rather on the low side, for what may be termed the normal stock of the country. In that year the two groups of counties I have chosen had each about $2\frac{1}{2}$ million sheep. In 1919 the sheep in the arable counties had been reduced by 28 per cent., and in the grass counties by 13 per cent., while the arable land in the former group had been increased by 3 per cent. and in the latter group by 16 per cent. The "Down" counties, Dorset, Hampshire and Wiltshire, which would not fall expressly into either group, but form a typical sheep-breeding district, show in the same period a reduction of no less than 37 per cent. in their total sheep stock, the increase of arable land being 4 per cent.

On a superficial view of these figures it might be argued that an extension of the arable area involves a reduction in the number of sheep. That this would be a fallacy needs no argument from me before an assembly such as this. Not only is arable land necessary for the intensive production of mutton and lamb, but conversely, the keeping of sheep is, under normal conditions in this country, the most effective and economical means of keeping many classes of land under the plough and of maintaining and extending the area under cereal crops. If this fact appears to have been disproved by the fact that sheep declined while arable land increased, the explanation is to be found mainly in the incidents of control. While the cost of production increased on arable land to a much greater extent than on grass land, the arable sheep farmer was prevented from obtaining the higher prices for the lamb and mutton he produced

which they would have fetched in a free market. The relative values of farm produce being abnormal, it was often more profitable to sell fodder crops as hay than to feed them to sheep, or to substitute corn crops for fodder crops on land which would otherwise have helped to maintain the flock. I am, however, venturing upon practical questions which are better left to be dealt with in the discussion.

In conclusion, I will add only that if the importance of extending the arable area and increasing the production of cereals is recognised by the nation, it must also be recognised that one of the means which will assist in securing that end is to ensure that confidence is restored to the sheep-breeding interest, which has for generations been in a large degree the mainstay of British agriculture.

OPEN-AIR PIG-KEEPING.

THE system of open-air pig-keeping has been carried out successfully at Tiptree, in Essex, by Messrs. Wilkin & Son, Ltd., who run a considerable herd of pedigree Large Blacks. The greater part of the ground (poor London clay) over which they run had long been allowed to fall into a bad condition, and when it was acquired a few years ago by Messrs. Wilkin, was not capable of raising good crops. To the pigs was entrusted the task of mending the land.

The animals are penned either with iron hurdles or chestnut pales, and Mr. S. Wilkin, who is in charge of the herd, finds that one acre will carry ten pigs for six months. Their shelter is of the slightest, either a three-wheeled hut which can be moved readily from one part of a field to another, or hurdles supported by posts and covered with some rough thatching material. The system of handling is to run and fold the stores and gilts like sheep and to run the sows in the pastures in charge of one foreman. The pigs are allowed to farrow in the open without attendance, and so far without casualty. They are kept as much as possible in even sizes and fed at several troughs, so that all may obtain a fair share of the small measure of concentrates given to them. Breeding is so arranged that the sows farrow in January and July, the theory being that the January-born pig is able to take advantage of the spring weather, and the July-born pig is able to grow strong before winter begins. For sows with a litter, up to 7 lb. a day of concentrated food are allowed. No ringing is practised; the pigs are not fed before being turned out, and being hungry and having plenty of space to cover do not trouble to root.

The methods of cultivation used are those that are often associated with the name of Mr. Wibberley, catch crops being raised throughout the year for the benefit of the herd. Rape, kale and clover seem to be the most useful food. Rye and tares are also used, but are not so much in favour. Mr. Wilkin claims that pigs graze more closely than sheep.

The meal ration consists of 40 per cent. palm-kernel meal, 10 per cent. fish meal, and 50 per cent. of such offals as are in the market. Pigs born at midsummer, 1919, wintered in November, December and January on rape with 4 lb. per head daily of the mixed meal and a fresh fold of rape every third day. In February they were put into an orchard under fruit trees and had an extra ration of 2 lb. of beans every week. In March they were run over young wheat and winter

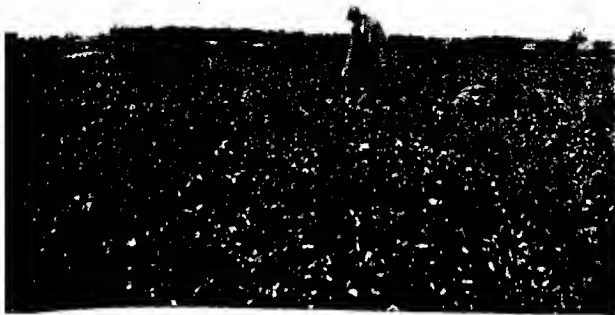


FIG. 1.—Pigs just put on new Fold.



FIG. 2.—Fold on Red Clover.

peas during the middle of each day. At 1 p.m. they were brought home and fed with a 4-lb. ration of the mixed meal. In April and May they were folded on rye, and ate it off much closer than sheep did. When it was not possible to fold them for a time during the winter, they received, in addition to 4 lb. of mixed meal, a few peas or beans. A 7-lb. ration for sows with litters appears to be the maximum allowance.

One of the most important factors in connection with this open-air pig-keeping is, of course, the benefit to the land. Mr. Wilkin claims that he can grow very heavy crops of corn, and that the whole agricultural position has been greatly improved. Before turning the pigs on, the land had to be cleaned and cultivated at a cost of more than double the purchase price, which, however, was very low. That the pigs respond to these conditions of open-air treatment there can be no possible doubt. Mr. Wilkin claims that many five-month gilts folded on rape and clover, with a 3-lb. daily ration, are fat enough to kill. The early January gilts farrow when 13 months old. There have been no cases of tubercle, and there have been no deaths in farrowing. Ordinary winter weather has had no bad effects, and sows have farrowed quite successfully under hedges in January.

A table showing feeding methods, material and prices is appended:—

	Ration per Pig per Week.		Cost of Meals and Peas per Pig per Week.		
	Meal.	Peas.	Meal.	Peas.	Total.
	<i>Oxley Hall.</i>				
	lb.	lb.	s. d.	d.	s. d.
50 Gilts, 20 weeks on Clover	7	4	0 10½	10	1 8½
	<i>Calves Pasture.</i>				
49 Gilts, 12 to 14 weeks on Vetches	14	1½	1 9	3½	2 0¾
	<i>Park Farm.</i>				
15 Gilts in-pig, on Mustard and Rape	28	—	3 6	—	3 6
Sows in-pig and with litters	49	—	6 1½	—	6 1½
	<i>Anchor Field.</i>				
25 Stares, Boars and Hogs, Rye Grass and Clover	21	1½	2 7½	3½	2 11½

Kind of Meal.	Price per Ton.	Price per Lb.	Percentage used in Mixture.
	£ s.	d.	
Fish Meal	22 0	2 3	10 per cent.
Barley Meal	24 0	2 5	20 "
Niddlings	14 0	1 5	20 "
Palm Kernel Meal ..	7 10	—	40 "
Maize Germ Meal ..	16 10	1 7	10 "
100 lb. of above mixture costs 12s. 6d.			
1 lb. " " "			1½d.

ECONOMIC POSITION OF THE POULTRY INDUSTRY.

EDWARD BROWN, F.L.S.

THE poultry industry has made great progress during the last six years. Those who were engaged in the business of poultry keeping before the War, and continued under the trying conditions of shortage in feeding stuffs, are rewarded by the more favourable situation now existing. Even those branches of poultry keeping which were regarded as more or less experimental seem now to have established themselves, and there is a clearer appreciation of the food value of eggs and poultry than was the case before the War.

Eggs have increased in price to a greater degree than most other regular articles of food, and what has been of great importance to the producer is that prices have been high in the spring and summer months when production is at the maximum. The prices of poultry, however, have not advanced to an equal extent, although the price of ordinary farm fowls increased more than for specially fattened kinds. During the early days of the War there was almost an entire cessation in the demand for fatted poultry, and as a consequence fattening plants reduced their output. With the shortage in feeding stuffs in 1917 onwards, the trade became unprofitable, and as a result of the fixing of maximum prices at a little more than 100 per cent. higher than the pre-war rates for poultry of fine quality, a considerable number of poultry fatteners in Sussex and West Kent went out of business. At present there is little prospect of the restoration of the industry on a large scale, as there is not sufficient margin between cost of production and the market returns, to provide an adequate profit.

The raising of ducklings for market has also suffered to an equal if not greater extent. Geese, on the other hand, have grown somewhat in favour, regaining among industrial workers a measure of the popularity they had many years ago. No actual figures are available as to the reduction in the number of turkeys raised in recent years. As they are essentially farm stock, the extra cost of feeding and raising has not been so great as in other branches of poultry keeping, and the chief reason for the decrease which has occurred appears to be that farmers have found other undertakings more profitable. It should, however, be possible to raise the breeding of turkeys to its former position within a comparatively short period.

As an indication of values of eggs and poultry, the following index figures of prices, taken from the Weekly Market Returns of the Ministry of Agriculture for certain months of the years 1913-1919, are given.

INDEX NUMBERS OF LONDON PRICES.

Eggs.

	1913.	1914.	1915.	1916.	1917.	1918.	1919.
February ...	100	100	125	142	208	324	430
May ...	100	100	120	147	211	378	350
August ...	100	105	122	153	210	366	335
November...	100	106	120	155	197	324	264

Poultry.

	1900	1901	1902	1903	1904	1905	1906
February ...	100	99	97	115	132	220	211
May ...	100	100	107	128	141	252	212
August ...	100	95	103	127	146	246	224
November...	100	89	108	128	157	225	212

The main factors in the increased prices of eggs and poultry, especially the former, are the great decrease of imported supplies. The following table, prepared from figures given in the Trade and Navigation Returns of the Board of Trade, gives the relative quantities of eggs and poultry imported in 1913 and 1919 respectively. In 1918 overseas supplies of eggs were about half the quantity of the imports during 1919.

Imports.

Country.	Eggs, in Thousands of Gr. Hundreds*			Poultry, dead (in cut.).	
	1913.	1919.		1913.	1919.
Russia ...	11,453	—	...	119,944	8
Denmark ...	4,265	1,638	...	—	—
Germany ...	514	—	...	—	—
Netherlands ...	977	—	...	—	—
France ...	702	6	...	31,175	3,083
Italy ...	846	—	...	—	—
Austria-Hungary	884	—	...	26,674	—
U.S. of America	6	1,409	...	54,242	100,512
Egypt ...	1,096	759	...	—	—
Canada ...	2	1,477	...	—	—
Other Countries...	835	355	...	46,430	43,964
	<u>21,580</u>	<u>5,644</u>	...	<u>278,465</u>	<u>147,567</u>
Decrease per cent.	—	73.8	...	—	47.0

* A great hundred of eggs = 120.

So far as prices are concerned, the average declared values* per unit of all imports work out as follows:—

	1913.	1919.	Increase per cent.
Eggs, per great hundred	8s. 10½d.	30s. 6½d.	... 245
Poultry, dead, per cwt. ...	68s. 7d.	207s. 1d.	... 202

How far we may anticipate that imported supplies of eggs and poultry will increase to any great extent is a problem for consideration. It will naturally be determined by the extent to which foreign countries will be able to recover their former output, and the increase in the number of poultry kept in this country both for eggs, breeding and table purposes. The question of price and demand will necessarily be involved in the consideration of this problem.

In 1913, more than 94 per cent. of eggs imported into the United Kingdom were received from European countries. The future position must largely be determined by the extent to which this trade can recover, and a brief survey of the position in various countries may be instructive.

In 1913, 53 per cent. of the total imports of eggs into the United Kingdom were received from Russia. The prospects of export from Russia being revived are small, and as Germany was the largest buyer of Russian eggs and poultry before the War, it is probable that when trade is resumed again the bulk of supplies will find their way to that country.

In 1913, Danish eggs represented 19.76 per cent. of our total imports, but as a result of the War the number of fowls kept in Denmark have largely declined. Although in 1919 imports of Danish eggs consisted of 29 per cent. of the total imports of this commodity into the United Kingdom, the actual quantities received were less by 64 per cent. than in 1913. In pre-war days large quantities of Russian eggs were imported for consumption in Denmark, and in consequence of the cessation of this source of supply there has been a reduction in the quantity of home produce available for export. A rapid increase may be anticipated, although the prices obtainable in Germany may lead to a greater proportion being sent to that country.

The position in Holland is very similar. In 1913, 4½ per cent. of the total imports of eggs into the United Kingdom came from that country. In 1919 this figure has been reduced to only a small fraction of 1 per cent. It may be anticipated, however, that production will be rapidly increased, although Germany is

* The declared value is the value (cost, insurance, freight) as declared to the Customs Officers at the port of arrival.

likely to be a serious competitor for supplies. Formerly, all surplus poultry from Holland went to that country.

In 1913 France was responsible for $3\frac{1}{2}$ per cent. of the eggs imported into the United Kingdom, whereas in 1919 the supplies from this source were insignificant. The margin of eggs and poultry available for export was always relatively small, owing to high consumption at home, and it does not seem likely that any great supplies will be derived from this source.

The three countries which have sent the greatest volume of supplies since 1914 are Egypt, Canada and the United States of America. As far as can be anticipated, imports of eggs from Canada and Egypt will continue, unless prices fall very heavily, but it is unlikely that the United States will under normal conditions ship eggs to the same extent as during the War, although she may maintain export of poultry. The imports of eggs in 1919 from Egypt, Canada and the United States only represented 17 per cent. of the total imports in 1913, so that they do not present a serious factor in competition with the home market.

Large as were the imports in 1913, the actual quantities relatively to the population were small. Before the War 56 eggs per head of the population were imported, while in 1918 and 1919 the imports were respectively 7 and 14 eggs per head. There is therefore not only an imperative need for production to meet the shortage of imported supplies, but also to provide for an anticipated increased demand. At the last poultry census of which a report has been published (1908), there was only about three-quarters of an adult fowl per acre of cultivated land in England and Wales. In the opinion of the writer an increase of about one and one-third of the total number of adult fowls would make up for the reduction in imports.

The extent of the change since 1908 cannot be estimated. In 1917, when feed began to be scarce and dear, there was probably some reduction in the number of poultry maintained, but at the present time it is likely that an increased number of people are keeping poultry as compared with the number before the War.

Extension of production would be most easily attained upon farms, and the number of farm poultry could probably be increased threefold without causing displacement of other stock or interference with crops. Owing to the large amount of natural food obtainable by poultry on an open range, the costs of feeding and equipment are comparatively low, and this is the most economic and profitable method of production, whether of

eggs or table poultry. Its weakness is in its low winter output of eggs, but all the signs indicate that farm poultry will be more profitable in the future than in the past.

One of the effects of the War has been to stabilise commercial poultry farming for egg production. This branch of the industry has now assumed a firmer position, owing to the more general adoption of proper methods and to the enhanced prices which are obtained for produce. Great progress has been made and will most likely continue to be made, but there is yet much to learn. Many problems are unsolved. Results will largely depend upon a higher average production. The principal difficulty for those taking up the business at the present time arises from the high cost of equipment, and until prices of materials fall very considerably capital expenditure will be heavy. Domestic poultry, whether owned by residents in towns or country, have increased largely of late years. Small individually, in the aggregate this source of supply is very appreciable, and is capable of enormous extension. Economically, this aspect of the industry is one of the most promising.

The high prices obtainable for stock may be held to have considerably strengthened the position of breeding farms. Prices have increased by 200 to 400 per cent., and there is a considerable demand. Poultry breeding, which was always the best paying branch of the poultry industry, has during the last three years attained still greater importance. The day-old chick trade has also increased very largely, and more breeding farms and hatching stations are likely to be required as poultry keeping increases. It may also be mentioned that the importance of paying regard to utilitarian qualities in exhibition poultry is now recognised to a greater extent.

During recent years knowledge of the principles underlying poultry breeding and management has been acquired as the result of wider experience and more careful study of the problems involved. There is, however, still a comparative lack of knowledge, and in particular there is need for the extension and development of scientific experimental work, and inquiry into the causes and prevention of disease. The two main purposes of the promised National Poultry Institute should be (1) experimental work of the nature indicated; and (2) the training of Instructors, who in turn will be able to teach farmers and managers of, or workers on, larger poultry farms advanced and more profitable methods. Efficient training and instruction among our rural population, both men and women, as assistants to farmers and others, is required.

UTILITY RABBIT KEEPING AT PUBLIC INSTITUTIONS.

IN 1912, as a result of the study of notes on rabbit keeping issued by the Board of Agriculture, the authorities at a hospital in the south-east of England decided to test the possibilities of rearing rabbits. It was felt that the large amount of waste food-stuff left over at the hospital would offer special facilities for the feeding of the rabbits, and that the undertaking would thus be a means of assisting in the general economy of the establishment. While, if the experiment proved a success, the lessons might serve to encourage similar Public Institutions in the country to take up work of a like nature. As the initial stock for the experiment, thirteen does and one buck were purchased. The following notes have been contributed by the Steward of the Public Institution referred to:—

During the first year the rabbits were all housed in hutches made at the Institution. With a view to effecting economies in expenditure on equipment, however, it was later decided to proceed as much as possible on outdoor methods, and an attempt was made to extend the rabbitry by means of a warren.

To this end a small gravel pit with a sloping run leading to a partially shaded plateau was utilised. The pit was sheltered on one side by a thatched "lean-to," and on the other by tree trunks and brambles. The rabbits placed in this area increased in numbers, and surplus stock were from time to time removed, but after some months they were attacked by disease and the experiment was discontinued.

Breeding and rearing have since been confined to the hutch system, ordinary hutches being used for breeding, and long, wire-bottomed ones for the rearing of young rabbits. The latter hutches have the disadvantage of being rather wasteful of straw, but this disadvantage is more than counterbalanced by the small amount of labour necessary to keep the hutch clean and the fact that the floor is always in a dry condition.

Value of Produce.—During the year ended 31st March, 1915, in spite of inexperience at the initial stages and the severe check received as a result of the outdoor experiments, 1,481 lb. of meat were produced for home consumption, and 1,715 lb. in 1916. Last year (1919) the rabbits reared produced over 4,000 lb. of meat.

The cost of feeding during the years ended 31st March, 1919, and 31st March, 1920, was £42 and £88, respectively, and the

value of the returns in the form of meat and other produce was estimated as £83 and £187. A portion of these amounts was received from the sale of skins.

The above profits were made from cross-bred Flemish-Belgians and pure-bred Belgians. They would probably have been much larger had the best fur-producing breeds been kept from the start, as the pelts from these are now commanding a high price in the market.

Breeds.—From the writer's experience larger types of rabbit (Flemish Giant, or Flemish-Belgian crossbred) are not so profitable as some of the newer breeds. At present, on account of the high prices obtainable for pelts, the production of a larger type of Silver Grey and the breeding of Havanas and Beverens has been adopted in preference to utility rabbits. Of these the Silver Grey and Havanas mature earliest.

If cross-bred does are used it is desirable to mate with small-boned cobby bucks, such as Silvers, Dutch and Havanas, as the progeny of these crosses are preferable for fattening and produce a minimum of offal. Of the pure-bred crosses, apart from the question of pelt, the Belgian Hare doe crossed with a Silver Brown buck is, in the opinion of most judges, the best cross.

Feeding.—A medium-sized doe (7 lb.) with a litter of 7 a fortnight old should do well during the winter months on a daily ration of :—

6 oz. Bran.
1 „ Fish Meal.
8 „ Green Food.
1 „ Hay.

If it is desired during the winter to force the youngsters for killing at 16 weeks old, single fattening pens for housing are preferable.

For the medium-boned varieties (Beveren) a suitable daily ration is :—

1 oz. Bran.
 $\frac{1}{2}$ „ Fish Meal.
8 „ Green Food.
 $\frac{1}{2}$ „ Hay.

A breeding doe during the winter will thrive on a daily ration of :—

3 oz. Bran.
 $\frac{1}{2}$ „ Fish Meal.
1 „ Hay and a fairly plentiful supply of green food.

Well-grown 8-week youngsters will thrive from March to August on *ad lib.* supplies of succulent green food, with a minimum of $1\frac{1}{2}$ lb., supplemented by $1\frac{1}{2}$ oz. of hay. Water should

always be placed in the hutches, and grasses should be gathered from open sunny spots.

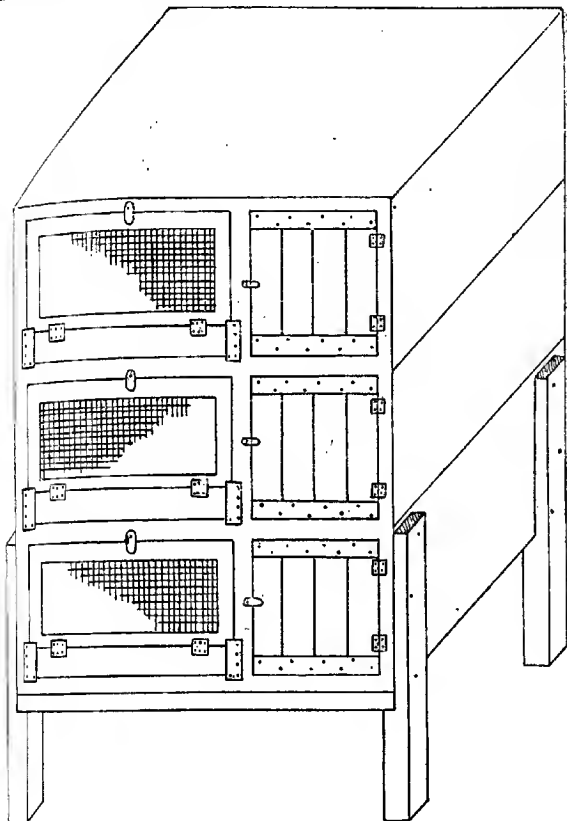


FIG. 1.

Hutches.—Bacon boxes are easily converted into hutches, and are at present obtainable at prices ranging from 2s. 6d. to 3s. 6d. each. Wire and felt are additional items of expenditure.

The outlay may be cheapened and space economised by making single hutches in sets of three (Fig. 1). It is found better to have a breeding section in each hutch, instead of loose nest boxes. Fattening pens can be made from sugar boxes and fixed in tiers to suit the space available. The writer has found that a set of nine compartments (Fig. 2) is the most convenient for handling.

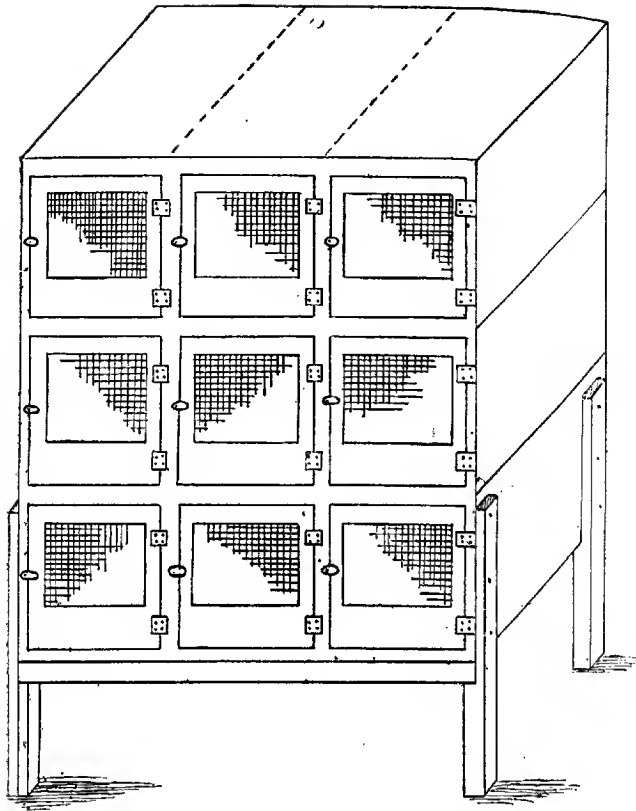


FIG. 2.

Some protection is necessary against rain or snow during the winter months, and condemned waterproof sheeting has been used for this purpose. The only objection to such sheeting is that it is untidy. Shutter boards with ventilation holes look better, but are more difficult to control. The insides of all the hutches should be periodically limewashed.

Feeding troughs have been made from old boxes at the Institution, but as the rabbits usually nibble these away very quickly, flanged earthenware pots are now used. These pots cost less than 6d. each.

Breeding.—The writer has found it advisable to fix a card on each hutch to record the date that the doe is due to litter and

particulars as to productiveness and mothering value. Fat does are seldom of value for breeding. All does should be examined before mating, for vent disease. The best does for breeding purposes in the winter are those retained from spring litters of the same year. Does must be taken to the hutch of the buck; not *vice versa*. After one satisfactory mating the doe should immediately be taken back to her hutch. Nothing is gained by a second mating. Only healthy does should be used for breeding, and the youngsters from the litter which make the most rapid growth should be retained for the purpose.

The writer would advise beginners to purchase at the commencement only a few does and a really good buck of the breed decided upon. In the case of a Public Institution it is possible that one or more members of the staff may possess a knowledge of rabbit keeping, in which case he should instruct those who would have the care of the stock in the principles of the subject.

In conclusion, it may be stated that the addition of rabbits to the utility live stock kept on the premises in question has provided not only open-air recreation and interesting work for a number of the inmates, but also a ready supply of meat, which has given a welcome variety to the menus of both staff and patients. Bearing in mind the urgent necessity for increasing our home production of food, the huge quantities of rabbits annually imported, and the fur shortage, and having regard also to the exceptional facilities which a Public Institution possesses for the profitable rearing of rabbits, the keeping of such live stock is well deserving of careful consideration, and may be urged upon all those concerned. Apart from the advantages in the way of food, the financial returns from the undertaking should mean a corresponding reduction in the burden of the local rates, and the idea might properly commend itself to local authorities on these grounds.

BUILDINGS FOR SMALL HOLDERS:

EXPERIMENTS IN ADAPTATION.

CAPTAIN S. DOUGLAS MEADOWS.

IN these days of soaring prices, when established pre-war ideas as to building costs have become obsolete, it behoves everyone interested in the equipment of the new small holdings which are being created under the Government's Scheme of Land Settlement for ex-Service men to test every means which might suggest itself for carrying out building operations on the most economic lines, consistent with efficiency. Any existing buildings which by alteration, and possibly addition, can be adapted to the purpose in view should be utilised to the fullest possible extent.

In the case of farm buildings, it is particularly necessary that the fullest advantage should be taken of any existing buildings which can serve any useful purpose in a new scheme of equipment. The isolated position of most farms, and the absence of good roads to them, make haulage of building materials a considerable item of cost, and the adaptation of these existing buildings is a far cheaper proposition than the provision of new equipment would be.

Old farm buildings are generally of the rambling type, and do not appear to have been designed on any definite principle. They are often spread over a wide area of land that could be more profitably utilised in other ways, and they are rarely built square in themselves or with each other. A good deal of space is wasted in this manner which could be utilised to some purpose by a little thought and ingenuity in the adaptation of the buildings. Waste space, cumbersome and rambling buildings, although they may be picturesque in appearance, are uneconomic in the pressing needs of up-to-date farming. Buildings must be judged only from the point of view of their efficiency, and beauty in artistic design should be made to conform to this consideration.

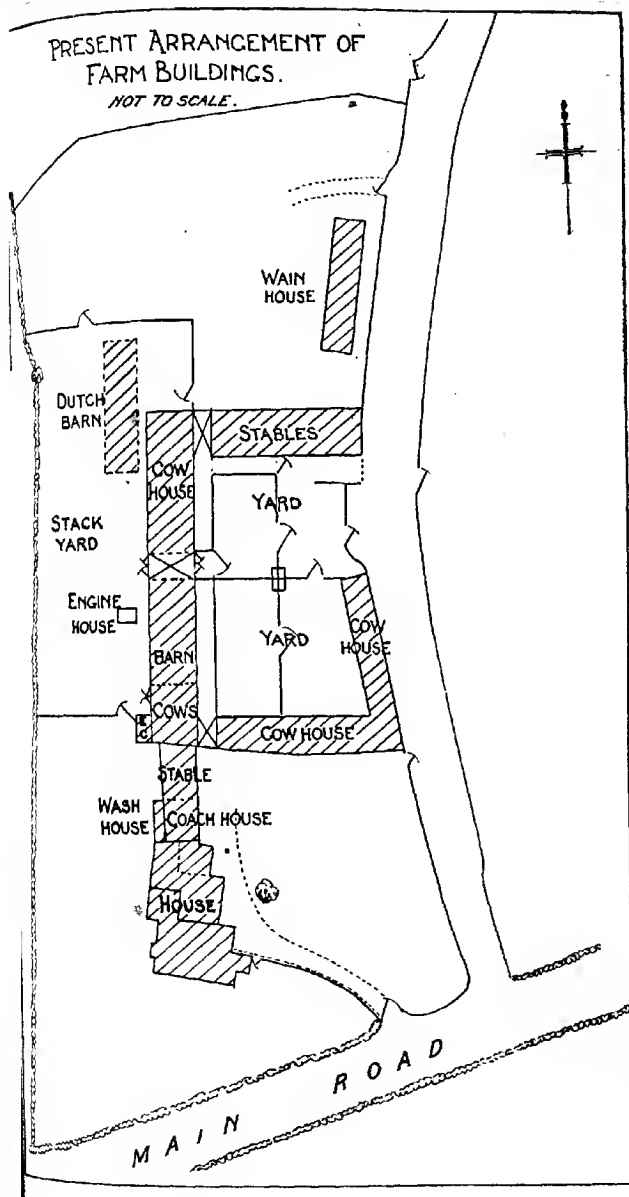


FIG. 1.

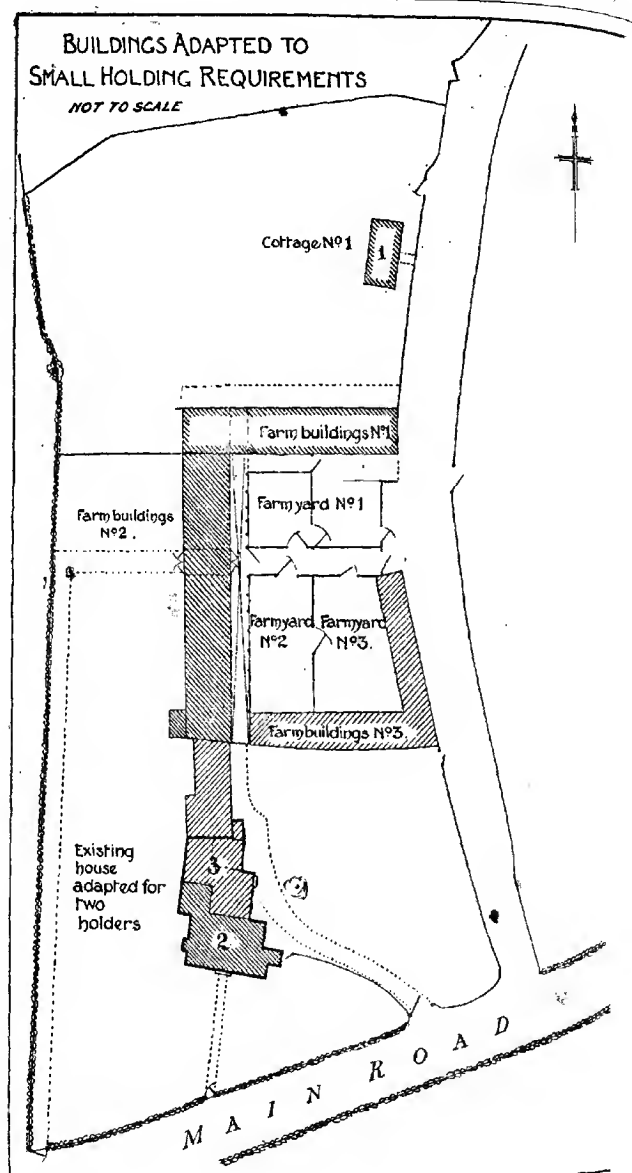


FIG. 2.

On a great many farms, therefore, certain unnecessary and inefficient buildings may be dispensed with to provide room and material for more up-to-date accommodation, making a really useful farmstead. The materials thus provided will be to hand on the site, no carting will be necessary, and the old material not used in the actual adaptation may be utilised for road-making and concrete work.

Road-making is of importance, and a good approach is becoming increasingly necessary with the extended use of mechanical vehicles.

Each case of adaptation must, of course, be dealt with on its merits. It will be necessary, first of all, to know what accommodation is required, and how it can best be provided. A survey of the buildings is necessary, so that the whole scheme may be viewed in its true perspective, and in proper relation to its surroundings. After the general scheme has been settled, details may be decided on the site. In this connection it may be well to advise against considering details before the general scheme has been decided upon. The accommodation for cows, stock, horses, pigs, and the various other animals on the farm should be arranged for, and the position marked in the general scheme; details as to position of doors, windows, &c., can be considered after the main lay-out is settled.

Old farm buildings frequently have many different floor levels, with consequent steps and angles. Generally, on the ground floor plan this can be remedied, and the floor made up to the same level throughout. This alteration cannot be so easily carried out on the first floor, however, especially in half-timbered buildings. It will make for convenience if all floors can be made level. It is advisable, also, to square up a plan, if possible, eliminating dirty and dark corners, and opening up covered-in spaces.

By dividing an existing farm into two or three holdings, it is often possible to provide more accommodation at considerably less expense than if entirely new work were undertaken. The accompanying illustrations of a farmstead on the Ministry's estate at Bosbury, Herefordshire, afford an example of how existing buildings have been altered, with comparatively little expense, to meet modern requirements. The farm buildings have been divided into three, the house into two. A new cottage will subsequently be provided for the third set of farm buildings. The farm did not lend itself particularly well to division, but with some ingenuity it has been possible to equip two 50-acre

holdings, and a third holding may ultimately come into the scheme.

The general lay-out of the farmstead is shown in Fig. 1, and its proposed adaptation and sub-division in Fig. 2. A common road through the farmyard makes separate entrance to each of the yards possible (compare Figs. 1 and 2). Owing to the difference of level it is difficult to depart very drastically from the old means of approach to the farm buildings, but these have been improved and made good.

The house, a red brick Georgian farm house with remains of an older building, has been divided into accommodation for two families. The third cottage will be built later. As a result of the adaptation each house will contain 4 bedrooms, living room, parlour, wash-house and dairy, with a third of the farm buildings.

Fig. 3 shows a plan of the ground floor (of the house) before adaptation, and Fig. 5 the manner in which the rearrangement and alteration of the various rooms have been carried out.

Fig. 4 shows the first floor before adaptation. It will be seen that a large amount of useful space is wasted in landings and corridors. By rearranging the northern staircase, access is obtained to the bedrooms without passing through the living room of house No. 3, and by removing the corridor, a small bedroom in house No. 3 is enlarged to a useful size, and a box-room in house No. 2 is converted into a bedroom (compare Figs. 4, 5 and 6).

Fig. 7 shows the progress of the work of alteration. The cost of this adaptation will be about £500, the work on farm buildings will cost another £500, and the new cottage £1,000. At a cost of £2,000, therefore, three holdings will have been equipped, and a good deal more accommodation provided for the money expended than would have been possible if entirely new buildings had been erected.

Wherever possible, an absolute division of the holdings has been aimed at. Small holdings should not overlap, or small holders trespass upon the land of their neighbours. This point should at all times be taken into account, in the interests of the harmonious working of the settlement. In the case illustrated, entirely separate approaches have been provided to each set of farm buildings, and each farmstead stands on its own land.

On some farmsteads a common dairy may be provided when small holders propose working together on a co-operative system. This has not been done in the case here mentioned, as each of the small holders is farming differently.

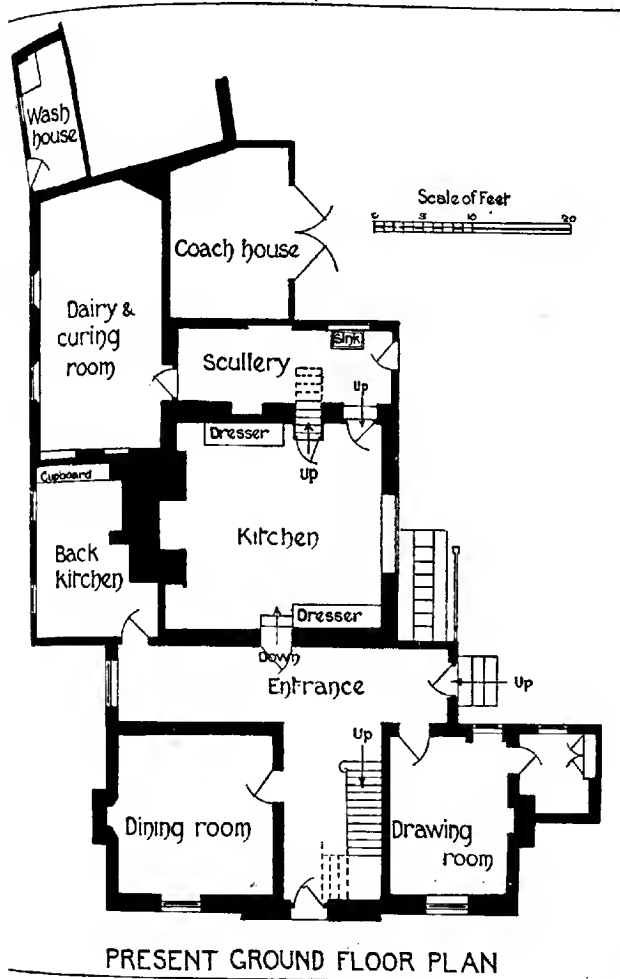


FIG. 3.

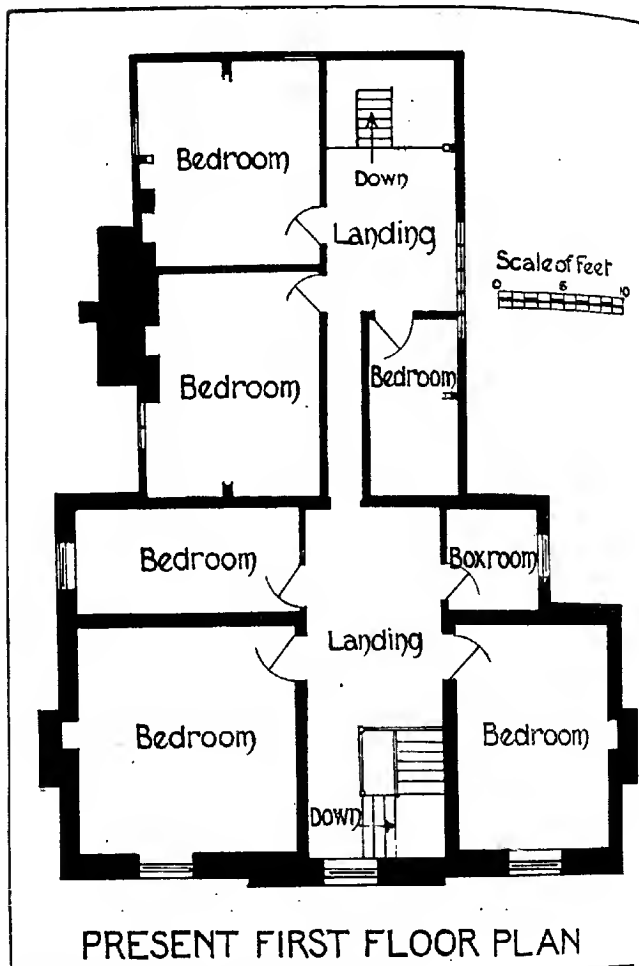


FIG. 4.

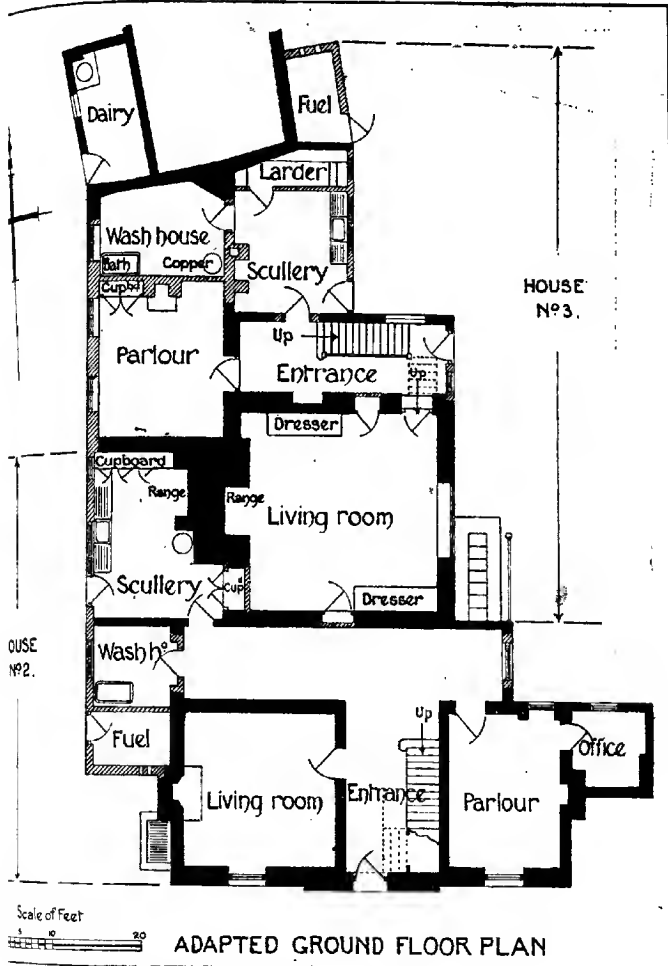


FIG. 5.

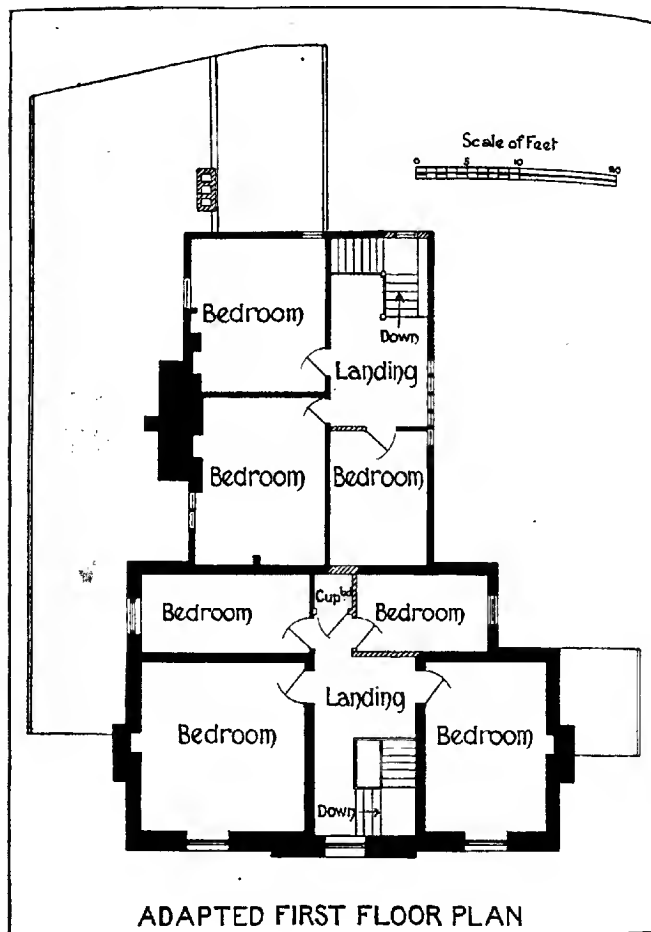


FIG. 6.

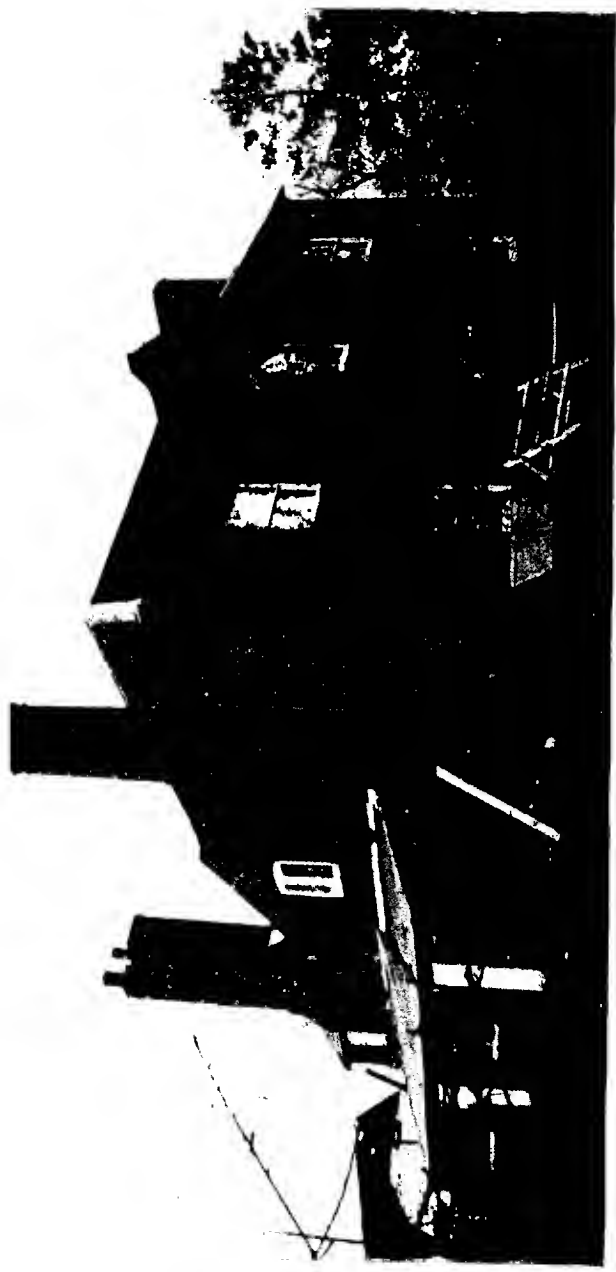


FIG. 7.—Farm House at Beshury showing progress in the work of adaptation.

At **Bogbury** the existing buildings were all utilised, and very little **puffing down** was done. All old material was re-used in some way or other, and the scheme has proved most economical.

The work of adaptation was carried out by direct labour by men of the estate, with some assistance from outside bricklayers, carpenters, plasterers, and other workmen. All the roads were constructed with unskilled labour under the supervision of an experienced roadman. A quarry was opened on the site, and supplied material for the roads and certain building work. Very little excavating was done for the roads, the virgin soil only being removed to a depth of some 6 inches. The cost of road-making was 10s. per yard, which included quarrying of stone and surfacing with clinker. The clinker was obtained free from the Malvern Electric Works, but, of course, had to be hauled to the site. The roads were 9 feet wide and about 9 inches deep.

It is very essential that there should be an adequate water supply which can be relied upon during the dry summer months. To this end it is desirable to obtain the advice of an expert water diviner and engineer. This has been done on the estate in question, and a central supply from a boring is being installed. Drainage is very closely allied with water supply. In this connection existing drains should be utilised as far as possible, but if there is any possibility of their contaminating the water supply, a new system should be put down. Farm sewage is an essential farming commodity, and should be conserved, and not diluted by mixture with the rain water or the house sewage. All three should be kept separate, as they each have their different uses. Rain water should be collected wherever possible for domestic purposes, and not allowed to run to waste in the farm drains, so diluting the liquid manure. House drainage, consisting of sink and bath waste, with, perhaps, a water-closet, needs separate treatment, and should not be connected with either the farm system or the rain water drains. The collection of the house drainage into a cesspool or surface irrigation system is usually not difficult, and is a most desirable arrangement. No elaboration of manholes or inspection chambers will be necessary; all that is required is a simple pipe line to a cesspool some 50 yards away from the house. In the case in question, old drains were utilised wherever possible, and a separate system was introduced for the house discharge. A rain-water butt or tank near the scullery door, with an overflow to the sink gully, is most useful, and helps to conserve the water supply.

These three 50-acre holdings will be equipped at a ~~cost~~[£] of about £3,000, or £1,000 each, including roads, water supply and fencing, and will be a very considerable saving over entirely new equipment.

The foregoing applies more or less to most small holding adaptations, and the secret of success lies undoubtedly in a careful study and survey of existing buildings. In many cases it is impossible to grasp the situation properly without getting the whole of the existing property carefully plotted to scale. It will then be possible to consider many suggestions before finally deciding upon the best means of carrying out the adaptation. In this way, therefore, indifferent buildings may be converted to modern requirements and serve a most useful purpose in the Land Settlement Scheme.

THE SCORCHING OF FOLIAGE BY SEA-WINDS.

L. A. BOODLE.

NEAR the coast, injuries to the leaves of trees and shrubs are often observable after a gale from the sea, some of the leaves becoming brown and withered as though scorched. Similar damage is sometimes caused several miles inland in exposed situations. In both cases this effect of the gale is often attributed to the injurious action of salt spray (or particles of salt derived from spray) carried by the wind and deposited on the leaves.

Evidence of the transport of salt by a strong sea-wind is often supplied by the appearance of a damp salty deposit on the seaward windows of houses standing with little protection a mile or two from the coast, while, in the case of a violent gale, an appreciable amount of salt may be carried to a great distance. As an example of the latter occurrence one may refer to observations recorded on the occasion of a great storm which visited Liverpool and various parts of the Kingdom in January, 1839. Ackroyd* states that during this gale "trees and hedges in many places, e.g., Huddersfield and Longton, appeared to be covered with a white frost, which on analysis proved to be a briny deposit which the wind had brought from the Irish Sea."

The question, however, whether or to what extent salt is responsible for the damage to foliage by sea-winds, is one that is not readily answered. Various writers have discussed this subject, together with the associated one of the cause of the characteristic form presented by trees and woods in proximity to the sea. In the case of isolated trees (which are stunted in proportion to the degree of exposure) the shape is asymmetric, the crown being more developed on the side away from the sea, while the side facing the sea shows numerous dead twigs or branches, testifying to repeated injuries on that side† The configuration of woods adjoining the coast gives similar evidence of injury by winds from the sea, in the dwarfing of the trees nearest the coast, and the gradual increase in height of the trees towards the landward side, where the wood itself gives progres-

* Ackroyd, *Chem. News*, Vol. 84 (1861), p. 56, as quoted by Blackledge, *Ann. Bot.*, Vol. 27, p. 169.

† The twigs in some cases may have been killed by frost in winter, as a consequence of the wood having been insufficiently "ripened" owing to the early destruction of the leaves (*Grübner, Lehrb. d. allgem. Pflanzengeographie*, 1910, p. 225).

sively increasing protection from sea winds. The clean-cut surface of the crowns, forming a uniform upward slope, also shows the connection between shelter and growth.

Some authors who have dealt with the subject explain the injuries as due to the direct action of salt, while others attribute them primarily to the drying action of the wind, or largely to mechanical injuries brought about by storms. A short consideration of these views is given below, with some references to the literature.

Föcke,* after referring to the damage to trees, in certain coastal regions of Germany, caused by winds, and especially by storms from the north-west, remarks that, where there is sufficient shelter towards the north-west, trees succeed quite well, even on the islands, but that they never grow higher than the protecting dunes or houses. He adds:—"The action of the sea-winds probably depends on the salt-dust which they carry with them."

Statements by other writers who hold the same view are mostly of a similar nature, injury by salt being inferred from comparative observations on the effect of exposure and of protection towards the sea. For instance, Anderlind,† after referring to cases in which pine trees near the coast showed browning or loss of the leaves of exposed branches, attributes this injury, and the damage shown by Dicotyledonous trees in the same situation, to the action of salt spray. Data of this kind, however, are quite inadequate as a basis for the solution of the problem, because the side facing the sea, and therefore exposed to salt, is ordinarily the side on which the full force of the wind reaches the trees, the velocity of the lower strata of air during a wind from the sea not having been reduced by conflict with various obstacles, as is the case with wind which has blown over any long stretch of land‡ other than a flat waste.

Injury by the Wind.—Thus the dependence of injury on exposure to sea-winds does not preclude the possibility that the phenomenon might be due entirely or largely to the action of the wind itself. This possibility is emphasised by the fact that the special forms characteristic of trees which have been repeatedly injured on one side are to be seen in various types of exposed

* Föcke, *Unters. über die Vegetation des nordwestdeutschen Tieflands*, *Abh. naturwiss. Verein.*, Bremen, Vol. 2, p. 405 (1871).

† Anderlind, *Die Wirkung des Salzgehaltes der Luft auf die Seestrandkiefer*, *H.-A. Forstl.-naturwiss. Zeitschr.*, 1897, ref. in *Just. Jahresbericht*, 1898, II, p. 312; see also Buchenau, *Bremen Abh. naturw. Verein.*, Vol. 3, (1873), p. 525; Evans, *Gard. Chron.*, 3 Ser., Vol. 59, p. 119.

‡ On a small island, where wind and salt may come from any quarter, the chief injuries show the direction of the prevailing winds or most frequent storms.

localities far inland, examples being found according to Warming* in oak-scrub in Central Jutland or in the centre of Switzerland." Statements of this kind, of course, leave some doubt as to the precise nature of the injuries which have ultimately led to the one-sided growth. There are, however, data which show that damage to leaves by wind in the absence of salt can be quite similar to that effected by sea-winds. An instance is given by a record of the scorching of leaves of trees and shrubs by a wind at Burlington, Vermont, U.S.A., in July, 1900.† The wind was described as unusually heavy and dry, and, being from the west, there was no question of the effect being due to salt. Leaves were killed on the west side of the trees, especially the outer trees along the western margin of the woodlands, and also on the same side of different shrubs, the scorching usually beginning at the apex and margin of the leaf.

Hansen,‡ who made observations on the East Friesian Islands, discusses the question of the cause of the injuries to leaves, noticed by him, at considerable length, and concludes that wind is the all-important factor responsible for the damage. The explanation of the phenomenon given by him§ and other writers is that, owing to the drying action of the wind, water is so quickly removed by evaporation from small portions of leaf-tissue that there is no time for conduction of water from the neighbouring cells, and that the tissue concerned consequently dries up and becomes brown. Hansen observed that the drying of the leaves began at the apex and margin, and that leaves were often completely killed, not by gales, but by long-continued winds of ordinary strength, the process of drying being a slow one, and progressing gradually from the margin inwards. The same type of withering, beginning at the apex and margin,|| may often be seen, as a result of exposure to strong winds, in different inland localities (away from exposure to salt), and is indeed a common effect of prolonged insufficiency of water in the leaves of trees, shrubs and herbs,¶ and may also be brought about experimen-

* Warming, *Oecology of Plants*, Eng. ed., 1909, p. 37.

† 13th Ann. Rept., *Vermont Agric. Exp. Sta.*, 1900, pub. 1901, pp. 281-2.

‡ Hansen, *Die Vegetation der Ostfriesischen Inseln*, Darmstadt, 1901. *This work contains numerous references to literature and much criticism. Kroll, *Wind und Pflanzenwelt*, Beih. Bot. Centralbl., Vol. 30 (1913), 1, p. 125.

§ Hansen, *loc. cit.*, p. 32.

|| Then sometimes in patches between the larger veins, the parts first affected being those to which water can be less rapidly supplied.

¶ Yapp, *Spiraea Ulmaria*, L. and its Bearing on the Problem of Xeromorphy in Marsh Plants, *Ann. Bot.*, Vol. 26, p. 816 (1912); Hansen, *Flora*, Vol. 93, p. 32 (1904). See also Schröder, *Ueber den Verlauf des Welkens*, Diss. Göttingen, 1909, ref. Bot. Centralbl., Vol. 114, p. 353 (1910).

tally, as was demonstrated by Hansen, by means of a "wind-machine."*

It is thus clear that injury to foliage, of the same type as that seen near the coast, can be caused by wind in the absence of salt. As, moreover, unprotected inland plains may exhibit damage to trees comparable in degree to that observed near the coast, and showing clear indications of the direction of prevailing winds, one may say that general observations, while not disproving the occasional occurrence of injuries by salt spray, suggest that the action of wind alone would be sufficient to account for a great part, at any rate, of the damage caused by sea-winds.

A case of the scorching of foliage by a gale from the sea on the coast of Chili is described by Ochsenius.† In a densely wooded coast-region, sharply limited tracts of forest showed dried-up leaves and twigs, in marked contrast to the fresh green foliage of the adjoining stretches of forest. The phenomenon, which is stated not to occur oftener than once in about ten years, is attributed by Ochsenius to the action of an unusually dry south-west wind, the sharp demarcation of the scorched areas being explained as due to the configuration of the land affecting the force of the wind. The question of injury by salt in this particular instance is dismissed by Ochsenius, who argues that, on account of the frequency of storms in the locality, no vegetation could have thrived on the temporarily scorched areas if wind-borne salt were the cause of the damage.

General observations on the effect of partial protection from sea-winds are, of course, not decisive as to the precise cause of injuries due to exposure. Hansen‡ refers to the relative success of trees planted behind screens of lattice and brushwood in Borkum and Norderney, and argues that, if salt were concerned as an injurious factor, the screen should have no effect, because, not being impervious to wind, though breaking the force of it, it would allow salt to pass through to the trees. Without information as to the amount of salt which in such cases actually reaches a partially sheltered position, however, no definite deduction can be made.

Borggreve§ attributes the injurious influence of wind on the growth of woody plants on the Baltic coasts of Germany chiefly

* Hansen, *Flora*, Vol. 93, p. 38.

† *Wirkungen der Stürme auf Pflanzen*, Abb. naturwiss. Verein., Bremen, Vol. 12, 1893, p. 434.

‡ Hansen, *Veg. ostfries. Inseln*, p. 34.

§ Borggreve, *Einwirkung d. Sturmes auf d. Baumveg.*, Bremen Abb. naturw. Verein., Vol. 3 (1873), p. 251; Gerhardt, *Handbuch d. deutsch. Dünenhaues*, 1900, p. 438.

to mechanical injuries.* Damage of this kind, of course, occurs during gales, but, in the region referred to, Hansen's observations† indicate that the drying action of storms and of long-continued winds causes injury to a much greater extent, and the same relation is probably of general application. Borggreve refers to the question of injury by salt, and states that storms from the sea on the Baltic coast as a rule only carry small quantities of salt. He also contends that trees protected by buildings, embankments, hedges, &c., would be equally or more exposed to salt than those standing without protection, because hoary particles suspended in the air would tend to be deposited where the air is less vigorously moved. The argument, however, is a superficial one, and is unsupported by direct observation of the distribution of salt under the conditions referred to. In comparing an exposed and a partially protected situation, one would probably be much less concerned with the settling down of salt particles owing to their weight than with the relative quantities of salt brought into contact with foliage by the wind in a given time, the salt being frequently either contained in spray, or brought in the form of damp particles which would adhere to anything they touch, while the amount of salt arriving in a given time would be decreased wherever the velocity of the wind is reduced. On the other hand it may be supposed that, in the special case of a very heavy spray being carried by a wind, the unprotected external foliage of trees may become so wet that the salt water, dripping on or blown on to the leaves of the interior of the crown, may eventually expose many of these to about the same amount of salt as that remaining on the exposed leaves. In the absence of definite data, however, it is inadvisable to base any argument on this supposition.

Before considering the manner in which salt might occasionally be a contributory cause to damage, some further remarks on the action of wind should be made. The effect of wind in causing loss of moisture from foliage by transpiration will depend on both the degree of dryness and the velocity of the wind. Dry air naturally favours transpiration, and wind in most cases has the same effect. In still air the water-vapour transpired by a leaf accumulates to some extent in its vicinity, thus checking transpiration, while during a wind the vapour-laden air is continually removed, so that the leaf transpires actually into drier

* Such as bruising and breaking of branches and leaves. Mechanical injuries may perhaps be caused by wind-blown sand in certain localities (see Gerhardt, *loc. cit.*), but probably chiefly to young leaves of shrubs.

† Hansen, *Veg. ostfries. Inseln*, p. 36.

air. Wiesner* found that in certain cases transpiration in a wind may reach twenty times its value in still air, and that the different behaviour of different plants depends largely on the partial or complete closing of the stomata during wind† and on the amount of cuticular transpiration. Though transpiration is usually increased by wind, it may be reduced in certain cases, as was found in *Saxifraga sarmentosa*, in which intercellular transpiration was stopped by the rapid closing of the stomata, and the cuticular transpiration was small. Young leaves, having a relatively high cuticular transpiration, would show a large increase in the amount of water lost through the cuticle during wind, and this increase would often considerably more than compensate for the reduction or cessation of stomatal transpiration by the partial or complete closing of the stomata. Young leaves may therefore be expected to be specially liable to wind-withering.

Injury by wind, being due to uncompensated loss of water by the leaves, will depend on the combination of a number of factors, viz.. those favouring transpiration and those diminishing the supply of water to the leaves. Among the latter would be dryness and coldness of soil, both checking absorption by the roots.‡ It is easy to understand, therefore, that the effect of a storm may depend to some extent on the character of the soil, on the season of the year, and on the nature of the weather preceding the storm.§

In this connection it may be pointed out that wind-borne salt might in some cases be a factor indirectly favouring injury to the foliage by wind. Supposing a considerable amount of salt spray to soak into the soil during a gale, the absorptive power of such roots as were reached by the salt would be temporarily affected,|| and the supply of water to the leaves would be interfered with in consequence.

* Wiesner, *Sitzb. Wien. Akad.*, Vol. 96 (1887), ref. Just, Jahresbericht, Vol. 13 (1887), I, p. 216.

† This does not occur in all plants. The stomata of *Hydrangea hortensis* were found by Wiesner to remain wide open even during a strong wind, greatly increased transpiration being the result.

‡ Kihlman, *Pflanzenbiol. Studien aus Russisch Lappland*, Acta Soc. Fauna et Flora Fennica, Vol. 6. No. 3 (1890), p. 38; Mollisch, *Unters. über das Erfrieren der Pflanzen*, Jena, 1897.

§ *Vermont Agr. Exp. Sta.*, loc. cit.

|| The roots after a time would in most cases resume normal absorption, as they would show a certain amount of adjustment of osmotic pressure. See Schimper, *Die indomalayische Strandflora*, 1891, p. 22. For an extreme case of the phenomenon observed in the roots of certain halophytes, compare Hill, *New Phytologist*, Vol. 7, p. 133, and Vol. 8, p. 103.

Direct Injury by Salt.—The question of direct injury to leaves by salt may now be considered. The leaves of most land plants, such as can be wetted, are slightly permeable to water with dissolved salts.* Experiments were made by Lewis† on the effect produced by immersing leaves of lilac, holly, arum and other plants in sea-water or in salt water containing about the same strength of sodium chloride. After immersion for 12 or 27 hours, all the leaves showed an increase in salt-content and a higher osmotic pressure of the cell-sap. In arum, lilac and *Camellia* the first effect of immersion was loss of weight, indicating extraction of water from the leaf, but after three to six hours a progressive increase in weight began, while in holly and *Cavendishia* the increase began at once. Leaves of lilac and arum showed a considerable wilting effect when sprayed with sea-water, thus showing that water may be extracted from the leaf in this way also.

Before immersion of the leaves, the leaf-cells of all the plants became plasmolysed when sections were placed in sea-water (i.e., the protoplasm of the cells became contracted), but in most cases a stronger solution than sea-water was required to induce plasmolysis of the cells in sections cut from leaves which had been immersed for 12 to 27 hours, adaptability in the osmotic pressure of the cells being thus shown. It is concluded that the plasmolysis of cells and the wilting of leaves induced in certain plants by the presence of salt spray on the leaves would, at any rate in many cases, be a temporary effect if a supply of water were available for the regaining of turgescence.

In all cases the cells of the leaves were found to be living at the end of the experiments, hence one may say that no evidence was obtained that the amount of salt taken up by the leaves in these experiments would have any toxic action.

In the case of the foliage of trees exposed to salt spray, a certain amount of salt would at times pass into the leaves,‡ but whether a toxic effect would be produced§ in any case, unless excessive loss of water by transpiration should also occur, is

* Pfeffer, *Physiology of Plants*, Eng. ed., Vol. 1, p. 160; Daudeno, *Trans. Acad. Sci.*, Vol. 7, part 2; Boodle, *New Phytologist*, Vol. 3 (1904), p. 39.

† Lewis, On induced Variations in the Osmotic Pressure and Sodium Chloride Content of the Leaves of Non-halophytes, *New Phytologist*, Vol. 11 (1912), p. 255.

‡ Blackledge, *Variations in the NaCl-content of non-halophytes*, *Ann. Bot.*, Vol. 27 (1913), p. 168. The observations in this paper are perhaps open to the objection that a comparison of the proportion of salt in the soil in different localities may give little or no indication of the relative amounts of salt which have seeped into the soil from time to time.

§ The data given by Coupin (*Rec. Générale de Bot.*, Vol. 10, 1898, p. 117) as to the strength of salt solution producing a toxic effect when supplied to the roots are of no service for the present question.

doubtful. Assuming a case in which wind causes severe wilting of the leaves, the cell-sap will become concentrated, and may eventually reach a stage at which the concentration of the salts dissolved in the cell-sap will be sufficient to cause "salting out" of proteids, thus injuring or killing the protoplasm.* This stage would be reached earlier (i.e., with less loss of water) when the percentage of salts in the cells has been increased by the absorption of salt from spray. In this way salt may be occasionally among the factors responsible for damage to foliage. The action of salt spray in extracting water from leaves would tend in the same direction, especially when the spray on the leaves becomes gradually more concentrated by evaporation,† the water extracted from the leaf being a loss to be added to that due to transpiration. On the other hand, cuticular transpiration would be stopped wherever liquid is present on the cuticle, and it must also be remembered that where spray is being evaporated the wind will be rendered less dry.

Conclusion.—The general conclusion from the foregoing considerations is that the scorching of foliage by sea-winds is chiefly due to the drying action of the wind, but that salt may perhaps occasionally contribute towards the production of an injurious effect.

* Blackman, *Vegetation and Frost*, *New Phytologist*, Vol. 8 (1909), p. 858.

† Since reabsorption of water by the leaf tissues from the film of salt water on the surface of the leaf might thereby be prevented.

PESTS APPEARING DURING AUGUST.

Potatoes.—In last month's notes mention was made that potato diseases were largely in evidence in the country, and that *Blight* may still be very common if the weather should be damp. Growers should make every effort to dig and store their potatoes in dry weather, as if potatoes are clamped wet it is almost impossible to prevent the spread of ordinary potato disease in the clamp. In some districts it is frequently an advantage in the long run to grow Second Earlies, as these ripen and can be dug before the weather breaks. It is often desirable, at any rate in gardens, to dig the potatoes before the tops have died down, as the prospect of a heavier crop by leaving the potatoes in the ground may be negated by the greater risks of disease. It is a general custom to leave potatoes on the surface of the ground for the skin to harden, and to let the tubers dry off before storing. If *Blight* is present in the adjoining rows, this should not be done, as the spores in the air settle on the tubers, and if left out over night especially the damp and dew may cause them to germinate. The tubers may thus become infected, and later, when the crop is clamped, the disease may spread and set up extensive decay in the whole clamp.

Leaf Curl.—This disease arises from the use of poor or diseased seed. It does not always affect the entire crop, but occurs scattered in the rows, often to the extent of 25 per cent. to 50 per cent., and even more. Plants affected with Curl yield a very poor crop, and the tubers are of small size. *It cannot be too widely known that seed saved from such plants gives rise to similarly diseased plants, and the tendency is for the disease to increase in intensity each year.*

At this season it may still be possible to recognise the plants which are so affected, but later on this is not possible. Where "seed" saving is contemplated, therefore, an inspection should be made at once, and the presence and position of curled and "miffy" plants ascertained. If there is any appreciable quantity, no seed at all should be saved from the plot. *The rule that should always be followed in seed-saving is, to select from the most healthy plants.* The common practice of allowing the entire crop to mature and then to pick out tubers of seed size cannot be too strongly condemned. It usually results in the larger, healthy tubers from robust individuals being rejected and the majority of the seed which is saved being the product of

curled and "miffy" plants. On light, dry soils in the warmer parts of the country it is not advisable to save seed at all, as the above-mentioned diseases develop and spread more rapidly under such conditions. Further details as to Leaf Curl will be found in Leaflet No. 164.

Wart Disease may be prevalent to an increased extent during August. The disease may often be seen on the surface of the ground as a green corrugated mass at the base of the stems. Later, however, rotting sets in, leaving only a black mass, the spores of the disease having been washed into the soil. When the potatoes are in this condition they should be taken up at once, and the warty material destroyed.

Corky Scab may also be found among the tubers. In appearance it resembles a bad attack of ordinary scab or rust, but the tendency is for the disease to appear on protuberances or on the end of the tuber, the affected surface being powdery. This disease has been known entirely to spoil a crop, but although of general occurrence, it is seldom serious except in damp spots and in certain soils. Lime, so useful against many soil diseases, does harm in this instance, and should be avoided.

Vegetables.—Another soil disease is the "Finger-and-Toe" or "Club Root" of the *Brassicas* and turnips. This is well known all over the country by the deformation of the roots of attacked plants. It is often very difficult to eradicate, but seems only to flourish in acid soils, and persistent and thorough liming will in time reduce, if not exterminate it. In bad cases it is of little use merely to scatter lime over the soil; what is required is a heavy dressing, in some cases up to 4 tons to the acre. Care should be taken in thus treating the soil not to re-infect it by feeding animals on infected material, as the spores will pass unchanged through the animals and be spread with the manure. Farmers should always be careful that they do not sow from the seed of infected plants.

Much confusion is often caused by the similarity in appearance between the galls of the turnip gall weevil and those in "club root." In the case of the weevil the galls can be opened, and the larvæ are visible within. Where weevils are present in the crop the turnip should be consumed as soon as possible, when the pest will be destroyed, while the land should be deeply ploughed to bury and so destroy any insects which have escaped. Stumps and roots should not be left about, as the insect can then complete its life history on them, and is ready to attack a fresh

crop in the following season. It is quite common for both the turnip gall weevil and "club root" to be present in the same root.

Fruit.—Although little can be done now to check the fruit diseases which are prevalent, it may be well to note for future guidance the treatment which should be adopted for certain diseases.

Plum trees which show signs of *Silver Leaf* should be marked, if it is not possible to deal with the disease at the moment. Where only a branch is infected, this should be cut off at once well back, so that no brown stain is visible in the wood. The cut surface should be treated with Stockholm tar. Trees that are completely diseased should be cut down either at once or in the winter, as if left they only die and produce spores which will infect other trees. It may here be pointed out that under the *Silver Leaf Order*, 1919, it is compulsory for growers to remove all dead wood on plum trees before the 1st April of each year.

Many apples will be found marked either with sooty blotches, or, in the case of varieties such as Cox's Orange, and also, more frequently, in pears, with deep cuts and cracks. This blotching is due to the attacks of the *apple* or the *pear scab*, and is the cause of great loss of fruit every year through disease, while the value of saleable fruit is depreciated by its bad appearance. It is now too late in the season for remedial measures to be of much benefit, but thorough and careful pruning in winter will remove much of the fungus in its hibernating form, and by spraying with Bordeaux mixture or lime sulphur before and after blossoming in spring a clean crop can be obtained. Full particulars are given in Leaflet No. 131.

Bushes which are affected with *American gooseberry mildew* should now be treated by "tipping" the diseased shoots on the older bushes, as no further growth may be expected. Infection of the soil by the falling winter spores may in this way be prevented. Young bushes, however, should not be tipped until later, except on hot soils, as fresh growth is very liable to develop and become infected with mildew.

In some districts the common *strawberry leaf spot* is very severe. The damage caused by this disease may be checked if loose straw is spread over the fields and fired. The diseased leaves are thus burnt without the crowns being injured, and new leaves will appear free from the disease.

FEEDING STUFFS IN AUGUST.

PROFESSOR T. B. WOOD, C.B.E., M.A.,

The Animal Nutrition Institute, Cambridge University.

SINCE the last issue of these notes in the May number of this *Journal*, the writer has received a considerable amount of correspondence on the subject of the meaning of *Food Units* and *Starch Equivalent*, from which it is evident that the use of these two terms causes much confusion. It has been explained on previous occasions that the value of a feeding stuff is two-fold: it possesses (1) a certain food value and (2) a certain manurial value. The method of calculating the number of food units in a ton of any feeding stuff takes this double value into account, and the cost per food unit therefore gives a measure of the total value.

Since, however, the idea of food units includes both manurial and food value, it is not possible to feed according to food units. This has been pointed out in these notes on several occasions, when it has been suggested that feeding should be regulated according to starch equivalents. To buy on the food unit system and to feed according to starch equivalents is certainly confusing.

The writer has therefore decided to work out prices on the starch equivalent basis in future, so that this confusion may be avoided. This course is possible now that the figures in the tables of manurial values of feeding stuffs, published in Bulletin No. 73 of the University of Leeds and the Yorkshire Council for Agricultural Education,* have been brought up to date. The method of calculation is to deduct the manurial value from the market price so as to get the net cost of the feeding stuff less manurial value, and to divide this net cost by the starch equivalent so as to get the net cost of one unit of starch equivalent. As in the case of food units, one unit is one-hundredth part of a ton, or 22.4 lb.

Before giving the table in which the calculation is made it is desirable to explain once more what the term "starch equivalent" means as used in this connection. This term has been used in several different senses; mostly to denote a theoretical food value determined by calculation. As used in these notes "starch equivalent" means the number of pounds of starch required to produce as much fat in a store animal as 100 lb. of the feeding stuff in question.

*These figures were published in this *Journal*, May, 1920, pp. 199 & 191.

Starch equivalents have been measured by direct experiment: the method may be illustrated by the case of a store bullock. The animal is first kept on what is known as a maintenance ration, that is to say, a ration which will just keep him going without gain or loss in weight. To this ration is then added a weighed quantity per day of starch. The animal increases in weight and puts on fat, and the amount of fat put on is accurately measured. It is found that for every 4 lb. of starch consumed, 1 lb. of fat is produced. The animal is again put on its maintenance ration until its weight is once more steady, when a weighed quantity of, say, linseed cake is added to the ration. Once more the animal increases in weight, and the fat laid on is measured. It is found that to produce 1 lb. of fat 5.4 lb. of linseed cake are required. For purposes of fattening, therefore, 4 lb. of starch are equivalent to 5.4 lb. of linseed cake, and 100 lb. of linseed cake are therefore equivalent to $\frac{4 \times 100}{5.4}$ = 74 lb. of starch. The starch equivalent of linseed cake is therefore 74 lb. per 100.

The starch equivalents of a number of the more important feeding stuffs have been found by direct experiments of this kind, and from these the starch equivalents of all the common feeding stuffs have been estimated. The accepted figures are given in one of the columns of the table below. They are accepted

Name of Feeding Stuff.	Price per Qr. of s.	Price per ton.	Manurial Value per ton.	Net Cost of Food per ton.	Starch Equiv.	Cost per Unit of Starch Equiv.	Cost per lb. of Starch Equiv.
Barley, English feeding ..	90/-	400	25 0 0	2 8	23 14 0	71	6.8
" Foreign ..	80/-	400	22 10 0	1 6	21 4 0	71	5.11
Oats, English ..	72/-	336	24 0 0	1 9	22 11 0	59.5	7.8
" Foreign ..	65/-	320	22 15 0	1 9	21 6 0	59.5	7.2
Maize, Argentine ..	72/-	480	16 15 0	1 5	15 10 0	81	3.10
" American ..	90/- to 100/-	480	21 0 0	1 5	19 15 0	81	4.17
Beans, Chinese ..	19/-	112	19 0 0	3 1	15 19 0	66	4.10
" English blue ..	100/-	564	22 10 0	2 13	19 17 0	69	6.11
Milners' oats—Bran ..			14 10 0	2 10	12 0 0	45	5.4
" Coarse middling ..			15 10 0	2 10	13 0 0	64	4.2
Meads—Barley meal ..			25 10 0	1 6	24 4 0	71	6.10
" name " ..			20 0 0	1 5	18 15 0	81	4.8
" Rice " ..			22 0 0	2 0	20 0 0	72	5.6
" Bean " ..			22 0 0	3 1	18 19 0	66	5.8
Cakes—Linseed ..			21 0 0	3 12	17 8 0	74	4.8
" Cotton seed ..			12 10 0	3 5	9 6 0	47	4.4
" decorticated ..			29 0 0	5 6	14 14 0	71	4.2
" Coconut ..			13 0 0	3 0	10 0 0	79	2.6
" Groundnut ..			13 10 0	3 9	10 1 0	57	3.6
" decorticated ..			18 0 0	5 5	12 15 0	73	3.5
" Pulu kernel ..			11 10 0	2 1	9 9 0	75	2.6
Brewers' grains, dried ..			11 0 0	2 7	8 13 0	49	3.6
" wet ..			1 12 6	12	1 0 6	15	1.4
Distillers' grains, dried ..			12 0 0	2 16	9 4 0	57	3.3
" wet ..			1 15 0	13	1 2 0	16	1.5

because rations compounded from these figures are found to be successful, not only in the case of fattening animals but for store stock, working horses, milch cows, and other animals.

In the table the price per unit of starch equivalent is worked out as follows: from the price per ton is subtracted the manurial value assessed at twice the figure given by Dr. Crowther in the Bulletin No. 73 of the Leeds University, above mentioned, to allow for the increased cost of manures. This gives the net cost of the feeding stuff per ton. This amount is then divided by the figure for starch equivalent, and the result is the cost of one unit of starch equivalent, exclusive of manurial value. By dividing the cost per unit of starch equivalent by 22.4, the cost per lb. of starch equivalent is found. This is a useful figure for computing the cost of a ration which is given in lb. of starch equivalent.

During the last two or three months there has been a considerable rise in the price of the cheaper feeding stuffs. Palm kernel cake, for instance, has risen £3 per ton, and millers' offals 41 per ton. This rise has, however, not extended to the more expensive feeding stuffs, such as barley, oats and linseed cake. The cereals are still the dearest class of feeding stuffs, costing, as a rule, over 3d. per lb. of starch equivalent. The cheapest cereals at the present time are maize and coarse middlings. In comparison with cereals, cakes are relatively cheap; all cost less than 3d. per lb. of starch equivalent. Palm kernel is still the cheapest cake on the market, in spite of its recent rise in price.

It does not seem opportune at the present time to give rations, while most of the live stock are out at grass, but the list of prices may be useful to those who intend to buy in their feeding stuffs for the winter.

NOTICES OF BOOKS.

The World's Food Resources—(J. Russell Smith. London: Williams & Norgate. 18s. net.).—At a time when very general interest, and in some quarters alarm, is felt in regard to the food supplies of the world, this book, by the Professor of Economic Geography in Columbia University, is opportune. Although it has only recently reached this country, it appears to have been completed at the end of 1918, and the author, in a prefatory note, remarks that "the problem of statistical illustration" was peculiarly unsatisfactory, as "conditions during the period 1914-18 were so disturbed that production figures would not serve as good illustrations."

Consequently, the statistics with which the book is crowded do not usually relate to a later period than 1913, although many allusions are made to the lessons to be derived from war-time experience. It would not be difficult to pick out from the voluminous statistics given certain figures of doubtful validity, apart from the common defect of including in the same table, and without qualification, figures of diverse degrees of accuracy. This, however, is almost inevitable in a broad survey which attempts to take into account the present and potential food resources of the whole globe. It is this breadth of view which renders the work especially valuable. It is refreshing to turn from the prevalent ratiocinations, based on temporary and local conditions, to a comprehensive review of all continents and climes. Whether the conclusions of the author are accepted in every detail or not, he at least brings the problem of future food supplies into reasonable proportion.

Starting with a discussion of wheat, which he says is the most highly prized breadstuff, not because it is the most nutritious, but "because wheat bread tastes a little better to most people than other breads," and after pointing out the wide range of climatic conditions under which it can be grown, he refers to the immense areas which are still open to its extension, and also to the great possibilities of increased yield per acre. He adds rye, barley and oats as almost equally suitable for bread, and indicates the wider range given by their inclusion as breadstuffs. Maize, on the whole, is not capable of much extension of area, but the cultivation of rice may easily be doubled or trebled. A number of minor cereals, such as millet, which is the chief cereal crop of Central and North China, are also passed in review.

A discussion of the distribution of cattle, sheep and swine leads to the general conclusion that the world's meat supplies are almost within sight of their ultimate limit of extension, and the wastefulness of meat production, if vegetable resources are limited, is insisted upon. The author, however, holds the view that of all the main articles of food, meat is the least essential, and he points out that countless millions of the human race live and flourish without it. Consequently, he holds that the consumption per head of meat-eating peoples could be greatly reduced without detriment to their health and vigour. So far as milk is concerned, the author insists strenuously on its dietetic value, and is of opinion that an enormous increase in present supplies is mainly a question of transportation, which the refrigerating chamber and the invention of processes for drying have simplified.

Professor Russell Smith is especially interesting in calling attention to new and as yet partially developed sources of food. He opens a notable chapter on

Fish Supply thus:—"The Sea! We have not discovered it yet. If man insists on eating animal proteins and wants a twenty-fold or a hundred-fold increase in the supply, I call his attention to the sea as a place where he may drop his prejudice overboard, investigate, and probably find food in amounts that are beyond present computation." The very recent discovery of the adaptability of vegetable oils as a source of fat supply is described in detail and illustrated by imposing trade statistics which are unquestionable. We are reminded that sugar, which now bulks so largely in our normal dietary, is of recent introduction. "Sugar has been all around us for countless ages but we did not know how to get it"—only the bees possessed the secret. The author draws the moral—"The appearance and use of sugar afford a good example of the service of science to man and of the changes that we may expect in our food supply."

Allusion has been made to the possibility of criticism in detail, and it is perhaps desirable to mention one or two points which affect this country. One is the repetition, by inadvertence, of the common, but erroneous, statement that England before the War produced "but a fifth of the food she ate"—the reference being of course to wheat alone. In a description of international trade in meat supplies, the importation by the United Kingdom of live animals is mentioned as if it still continued. In a section dealing with the future wheat supply of the world, a curious error, in which I have some personal interest, is made. Referring to the "alarmist paper" of Sir William Crookes, the author has a footnote which states that Lord Rhondda brought out a new edition of Crookes's book "with this frightened statement": "England and all civilized nations stand in deadly peril of not having enough to eat." This is followed by further extracts of similar purport. In fact, this statement was not made by Lord Rhondda, but by Sir William Crookes. The preface which Lord Rhondda contributed to the book contained no sign of "fright," although it endorsed the useful advice given by Sir William Crookes, that the aid of science should be enlisted in stimulating production, especially in this country. I may be permitted to add, that having known Lord Rhondda for many years and sat with him on the Council of the Statistical Society, I can testify to the soundness of his views on statistical subjects, and I may perhaps add that he would not have asked me to write a supplementary chapter to Sir William Crookes's book if he had thought it necessary to express "frightened" opinions.

But it is not by small points such as these that this book should be judged. In a chapter headed "The Ultimate Food Supply," the author's main contention is thus stated:—

"It has been shown in connection with nearly every article of diet save meat that we can easily and greatly increase the supply in the Western World. Nevertheless, it is perhaps worth while to consider the general question of the future food supply, because it is so generally believed that the chances of making a living are growing fewer, that the resources of the world for each man are less than they were a few years ago. This belief is not founded on geographic or scientific fact: it belongs in the same class with the idea in the mind of the horse when he sees a bar in front of him and he thinks he is fenced in, although he could easily tear down the fence with his soft nose. If resources appear to be growing scarce, the scarcity is due to the shortcomings of our suddenly

grown financial and industrial system, and from our quite unscientific method of distributing goods and wealth and holding property. It is true that the world has a fixed area, and that the number of mankind, despite the temporary destruction wrought by the Great War, is increasing very rapidly; but while the area is stationary and the material in the world is constant in quantity, the usable resources are also rapidly increasing. A resource is something which may be turned into or made to produce a useful commodity. Science every day enables us to have some new commodity, where before there was waste. Because of this creation, there is good reason for the belief that the available resources of the world are increasing quite as rapidly as the population, and that they will continue to do so for a number of generations, if man devotes himself to science and industry rather than to war."

The book may be commended as a comprehensive and well-informed world survey of the subject with which it deals, to all who take a serious interest in food supplies.

R. HENRY REW.

The Small Farm and its Management.—(James Long. London: John Murray, 1920. 7s. 6d. net).—The revised edition of this volume by James Long will prove a useful guide to the ever growing body of men and women engaged in or contemplating the business of small farming. The attractions and difficulties of the life are set out clearly and impartially. To be successful the small farmer must be prudent and industrious; he must be equipped with the necessary capital and experience; and he must pursue the methods of husbandry best adapted to the cultivation of a few acres. The road to success and the pitfalls to avoid by the way are indicated in simple and intelligible language that inspires confidence and interest.

In general, the author would pin his faith to milk and its products, to pig meat, poultry and eggs, to such crops as are necessary for feeding purposes, and to a selection of other crops for direct sale to the consumers. He believes in the plough policy for the small farmer, with a strong leaning towards arable dairying through the medium of soiling crops.

Excellent advice is given in regard to the choice of land. Heavy land, though cheap, requires men of much experience and large capital. What is wanted is sound, clean, medium land. The small farmer has neither the time nor the capital to make poor land fertile, and to a beginner land-cleaning is a heart-breaking job.

In the section dealing with crops the large as well as the small farmer will find much to interest and stimulate; the note on sainfoin is specially appropriate at the present time.

Implement, general equipment, and marketing in the light of modern requirements, likewise receive due attention, and the entire volume may be described as at once simple, comprehensive, practical and explanatory.

J. G. S.

The Electrification of Seeds by the Wolfryn Process—A Report of the Experiments carried out at Reading in 1919. (Martin H. F. Sutton, F.L.S. Reading: Sutton & Sons. 2s. 6d. net).—A number of experiments have been conducted during the last few years with seeds electrified under the Wolfryn process, in order to test the possibilities of obtaining increased yields from seeds treated by this method. The Wolfryn treatment, which was described

in some detail in an article published in the issue of this *Journal* for January last, consists in immersing the seeds in a solution of common salt and water (4 oz. to the gallon) or calcium chloride and water (8 oz. to the gallon), and applying an electric current to the solution, and afterwards drying the seeds, at a temperature of 100° F.

The experiments conducted by Mr. Sutton and described in his small pamphlet were intended to ascertain (a) whether the process is sufficiently beneficial as regards results to justify the expense it entails, (b) whether the benefit is due to the process as a whole, including the use of electricity, and (c) whether equally satisfactory results could be obtained by immersion of the seed without the use of electricity. With this object comparative tests were made of seeds untreated in any way, seeds treated by the Wolfryn Process, and seeds treated in the same manner as under the Wolfryn Process except for the actual electrification, which was omitted. The experiments included both a germination test under glass and a field test, and the seeds used were carrot, swede, cabbage and mangold. In the opinion of the author the results in both cases could only be regarded as inconclusive, one or two points only being slightly in favour of the electrified seed. The outdoor tests as a whole appeared to be no more conclusive than were the tests for germination, the returns from the electrified seed showing no advantage over the other sections, except to a small extent in the case of mangolds.

QUESTIONS IN PARLIAMENT.

Foot-and-Mouth Disease.—In reply to a question by Capt. Cooke, it was stated that the number of animals slaughtered during the last 3 months in connection with the outbreaks of foot-and-mouth disease was: cattle, 772; sheep, 5,265; pigs, 271; goats, 2. (13th July, 1920.)

Milk Prices in Wiltshire.—In reply to a question by Capt. R. Terrell, the Food Controller stated that he was informed that the average price received by producers of milk in the South-Western area during May and June was 1s. 2d. per gallon. The price in this area was governed by the fact that a considerable proportion of the milk produced at this season was not retailed as liquid milk, but had to be converted into cheese, and other milk products. (15th July, 1920.)

Potato Spraying.—In reply to a question by Mr. Jordell, in reference to an alleged difficulty in adequately spraying potatoes in West Norfolk on account of the shortage of sulphate of copper, it was stated that the Ministry exercised no control over the production or distribution of sulphate of copper. No information had reached the Ministry which would indicate that supplies were insufficient to meet the demand, provided that consumers were prepared to pay the market price. (15th July, 1920.)

Tenure of Allotments.—In reply to a question by Mr. Hallas, who inquired whether the Ministry is receiving representations from Associations of Allotment Holders, praying for security of tenure to be afforded to the allottees, and what steps it is proposed to take in the matter, it was stated that the Ministry was aware of the desire of allotment associations and allotment holders for security of tenure. Absolute security of tenure for allotment holders could only be secured by the land being purchased by the local authority or by the allotment holders themselves, but the capital value of

land in the neighbourhood of a town, due to its value for building, was, as a rule, too high to enable the land to be purchased for allotments, inasmuch as the allotment holders could not afford to pay a rent based on the cost. In such cases the only alternative was to hire the land until it was required for building, in which case it was clearly impossible to guarantee the allotment holders absolute security of tenure. (20th July, 1920.)

Ormskirk Potato Trials.—It has now been arranged that the summer inspection of the growing crops of potatoes planted for the Ormskirk Potato Trials shall take place on 10th, 11th, 12th and 13th August. Inspection on the first two days is by invitation from the Ministry and from the National Institute of Agricultural Botany, but the Trial grounds will be opened on the 12th and 13th to all interested in potato growing. The Trials, which in the past have been entirely under the direction of the Ministry and have been carried out on the grounds of the Ormskirk Institution, kindly loaned by the Guardians for that purpose, have now been transferred to the farm at Lathom, Ormskirk, recently purchased by the National Institute of Agricultural Botany. The Ministry will still retain responsibility for testing potatoes for susceptibility to or immunity from Wart Disease, and have extensive plots of potatoes planted on the farm for this purpose, including a large number of varieties from America, France, South Africa and New Zealand. They have also a considerable number of seedlings from breeding Institutions, potato raisers, and others.

Trials for other purposes will be carried out by the National Institute of Agricultural Botany, which this year has planted a very large number of demonstration plots of most commercial kinds of immune varieties of potatoes. These should prove attractive.

Rabies.—All restrictions on the muzzling and movement of dogs imposed in connection with the outbreaks of rabies in South Wales, in Oxfordshire and Buckinghamshire, in Kent, and in Surrey and Middlesex, have now been withdrawn.

The North Essex Scheduled District, comprising Colchester and the district between that town and the coast towns from Harwich to Brightlingsea, is the only district which is now subject to the restrictions on account of rabies.

Leaflets issued by the Ministry.—Since the date of the list given on page 298 of the issue of this *Journal* for June last, the following leaflet has been issued in the *Permanent Series* :—

No. 351.—The Improvement of Village Life.

In addition, the information in the following leaflets has been revised and brought up to date.

No. 15.—The Apple Blossom Weevil.

„ 42.—The Short-eared Owl.

„ 45.—The Starling.

„ 51.—The Barn Owl.

„ 67.—Favus or White Comb in Poultry.

„ 200.—Black Rot of Cabbages, Turnips, &c.

„ 216.—The Oyster-Shell Scale.

The following leaflet has been withdrawn from circulation :—

No. 256.—A Disease of Narcissus Bulbs.

Weather Forecasts for Farmers.—The Meteorological Office will, as in past years, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of a registration fee of 1s. and the cost of the telegrams, computed at 1s. per message.

The forecasts are drawn up at 10.30 a.m., 4 p.m., and 9.0 p.m. (summer time). Forecasts issued at the morning hour refer to the period covering the afternoon of the day of issue and the morning of the following day. Those issued in the afternoon and evening refer to the whole of the following day. All the forecasts include a Further Outlook of the probable weather beyond the 24-hour period whenever such a Further Outlook can be given.

Notifications will also be issued by telegram when conditions indicate that a spell of several days fair weather is likely, and again when the spell is about to break up. For this service a fee of 6d. is charged for telegraphy. A minimum deposit of 5s. against which the charges may be booked is required.

Applications for regular forecasts (as distinct from Spell of Notifications) should specify the hour of the forecasts desired (or hours if more than one telegram daily is required). They should be sent to the Director, Meteorological Office, Air Ministry, London, W.C.2, and should be accompanied by a cheque or postal order payable to the Meteorological Committee to cover the cost of the telegrams for the period during which the forecasts are to be sent.

Further particulars and printed forms of application may be obtained from the Director of the Meteorological Office.

Applications by telegraph for single forecasts shall be addressed to "Weather, London," and the reply should be prepaid.

Removal of Prohibition on the Export of Live Stock.—The Ministry is informed that an export licence from the Imports and Exports Licensing Section of the Board of Trade is no longer required in respect of living animals, for food, of all kinds, live game and live poultry, exported from this country, except to Bolshevist Russia.

Re-exportation of Horses from France.—According to a note published in the *Journal Officiel* (Paris), 21st May, 1920, the following decisions have been made by the French Government :—

1. For horses coming from abroad and only passing through France in direct and immediate transit, it shall no longer be necessary to obtain a permit from the Minister of Agriculture as a preliminary to re-exportation.

2. Horses coming from abroad will be allowed to stay in France and be re-exported within a period not exceeding six months, without incurring liability to Customs duties, on condition that the importers obtain from the Veterinary Service of the Customs Office at the port of importation a separate certificate indicating the breed, sex, age and detailed description of each animal. This certificate shall then be forwarded for confirmation to the Customs Export Office. It will, as in the case of (1) above, not be necessary to obtain a permit from the Minister of Agriculture before re-export.

Export of Oil Cake from France.—In the issue of the *Journal Officiel* for 2nd July is published a Presidential Decree, dated 30th June, affecting the export of oil cake from France. Under the terms of the Decree the export of oil cake and brewers' grains (*drèches*) remains prohibited, except under licence, and it is provided that, when such cake is allowed to be exported under

licence, an export duty is to be levied thereon at the rate of 25 francs per 100 kilograms (about 2 cwt.) net weight.

From the preamble to the Decree it appears that, owing to the stocks which have accumulated, it is intended to allow the export of oil cake during the summer months, up to amounts to be fixed by the French Ministry of Agriculture, for each month.

Restricted Importation of Lucerne Seed. The issue of *The Commonwealth of Australia Gazette* for 25th March last contains a copy of a Proclamation, dated 19th March, 1920, prohibiting, except with the consent in writing of the Minister of State for Trade and Customs, the importation into the Commonwealth of lucerne seed unless such seed is stained with safranin to the extent of not less than five per cent. of its total bulk.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Frazer, W.—Elements of Agriculture (10th Edition), (700 pp.). London: John Murray, 1919, 7s. 6d. net. [63(022).]

McCollum, E. V.—The Newer Knowledge of Nutrition: The Use of Food for the Preservation of Vitality and Health (199 pp.). New York: The Macmillan Co., 1919, 6s. 6d. net. [612.39.]

Saskatchewan Department of Agriculture.—Bull. 57:—Weeds: Their Identification and Control (2nd Edition), (62 pp.). Regina, Sask., 1919. [63.239(04).]

South Carolina Agricultural Experiment Station.—Bull. 202:—Tropa Potash: A Progress Report (24 pp.). Clemson College, S.C., 1920. [63.1673.]

Løng, J. E.—Vilde Planter I Håve, Paa Mark og Eng. (26 pp.). København: Chr. Cato, 1913. [38.19.]

Canada, Ministry of Agriculture.—Sessional Paper 10:—Report of the Dominion Experimental Farms for the Fiscal Year ending March 31st, 1919 (196 pp.). Ottawa: 1920, 15 cents. [63(06) (71).]

Dairying—

Martiny, B.—Der Wassergehalt der Butter (963 pp.). Berlin: Paul Parey, 1898. [63.721.]

Frøderiksen, J. D. The Story of Milk (188 pp.). New York: The Macmillan Co., 1919, \$1.50. [63.71(02).]

Belgium, Ministère de l'Agriculture.—Actes du Conseil supérieur de Perfectionnement de l'Enseignement agricole. Fascicule I. (67 pp.). Bruxelles, 1920. [37(463).]

Croce, Mrs. M.—The Soil and Its Care. A Treatise on the Care of the Soil, Digging, Manuring, Drainage, &c. Chalfont St. Peter, Bucks.: The Whins Medicinal Herb School, n.d., 2s. net. [63.1.]

Field Crops—

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CONTENTS.

NOTES FOR THE MONTH—	PAGE
<i>Continuous Wheat Growing—Sowing of Wheat—Milking Machines—</i>	
<i>Rural Education in Wales—Jam-making when Sugar is Scarce ...</i>	501
<i>Substitutes for Hay—Improvement in Poultry Keeping—Poultry Keeping</i>	
<i>in an Elementary School in Cornwall—Pink Discoloration of Cheese ...</i>	514
<i>Tobacco Growing in England—Potash Supplies—Milk Recording Societies:</i>	
<i>An Interesting Competition—Agricultural Wages Board—Harvest</i>	
<i>Wages—Foot-and-Mouth Disease</i>	522
THE MODERN COTTAGE: EXPERIMENTS IN PISÉ AT AMESBURY. <i>Clough</i>	
<i>Williams-Ellis</i>	529
GRASS AND CLOVER SEED GROWING IN GREAT BRITAIN. <i>S. P. Mercer,</i>	
<i>B.Sc. (Agric.) Lond., N.D.A.</i>	535
HOW TO PROTECT WHEAT: SOME NOTES ON FUNGUS PESTS. <i>A. D. Cotton</i>	
<i>THE NATION'S FRUIT AND VEGETABLES: PROBLEMS OF PRESERVATION.</i>	
<i>S. L. Benham</i>	553
THE HARVESTING OF MANGOLDS. <i>Wilfred S. Mansfield and Arthur</i>	
<i>Anon, M.A.</i>	559
HAND LOOM WEAVING. <i>Professor A. F. Barker, M.Sc.</i>	561
GROWING LATE FLOWERING RED CLOVER OR SINGLE CUT COW-GRASS	
FOR SEED	568
DOMESTIC FRUIT BOTTLING WITH OR WITHOUT SUGAR	566
GOOSEBERRY GROWING	572
FEEDING STUFFS IN SEPTEMBER. <i>Professor T. B. Wood, C.B.E., M.A. ...</i>	580
INSECT AND FUNGUS PESTS IN SEPTEMBER	583
AGRICULTURAL RETURNS, 1920	587
NOTICES OF BOOKS	590
QUESTIONS IN PARLIAMENT *	591
Ecclesiastical Tithe Rentcharge (Rates) Act, 1920	592
Rabies	593
Experimental Farm to Improve the Cultivation of Maize... ..	598
International Dairy Exhibition at Buenos Aires	593
Wet Weather and Animal Disease	594
Leaflets issued by the Ministry	594
Additions to the Library	595

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